Chemical & Engineering NEWS

October 15, 1979

Stratospheric ozone loss

The question is being raised again

Page 25

October 15, 1979
Volume 57, Number 42
CENEAR 57 (42) 1–60
ISSN 0009-2347

Chemical & Engineering NEWS

Cover: Predawn launch of balloon to take stratospheric samples for total chlorine analysis. Photo courtesy of Walter W. Berg, National Center for Atmospheric Research, Boulder, Colo.

4 Letters
5 Editor's Page

Concentrates
10 Business
14 Government
18 Science/Technology

The Departments
38 People
42 Awards
60 Newscripts

News of the Week

- ***Genes have been injected into mouse cells*** *using microsurgical methods; experiments could pave way to curing inborn errors of human metabolism.* ***Page 6***
- ***NSF deputy director George Pimentel*** *will succeed Melvin Calvin as director of LBL's Laboratory of Chemical Biodynamics upon Calvin's retirement in July 1980.* ***Page 6***
- ***Water-cleanup efforts*** *have been delayed by sheer size of construction grants program, other problems, but noteworthy gains have been made, according to EPA.* ***Page 7***
- ***Single chlorophyll molecules, not dimers,*** *are involved in oxygen liberation in photosynthesis reactions, Brookhaven National Laboratory scientists find.* ***Page 7***
- ***Chemicals is leading investment target*** *on a global basis and the major trend in international capital flow is toward the U.S., Conference Board survey shows.* ***Page 7***
- ***Use of sulfur-asphalt emulsion*** *as a paving material seems ready for commercialization with completion of major paving project using the material in Illinois.* ***Page 8***
- ***Three different nitrosamines*** *have been found in air samples taken by NIOSH near hot processes at a tire manufacturing plant in Cumberland, Md.* ***Page 8***

Business

- ***Chemical capital spending,*** *according to C&EN survey of 16 U.S. basic chemical producers, is likely to top 1978 level 13% or more as companies accelerate expenditures to meet budget targets.* ***Page 11***

International

- ***Polyurethane use worldwide*** *may exceed 7 billion lb in 1980—spurred by need to conserve energy, demand rises for rigid foam to insulate buildings, vehicles, and flexible foam to lower auto weight.* ***Page 12***

Government

- ***Fast-track energy projects bill*** *is passed by Senate; House versions to be voted on this month as Congress continues to wrestle with energy legislation.* ***Page 16***

Science

- ***Guidelines from the National Cancer Institute*** *aimed at reducing the risk of cancer by changing eating habits have added fuel to the debate on funding of nutrition research and peer review.* ***Page 20***

News Feature

- ***Stratospheric ozone loss issue*** *is coming under fresh scrutiny. Uncertainties still exist in ozone-depletion hypothesis, but major reports assessing it and offering ways to control chlorofluorocarbons soon will be received by EPA.* ***Page 25***

ACS News

- ***Fifth ACS Congressional Fellow,*** *Thomas Althuis, has completed his year on the staff of the House Science, Research & Technology Subcommittee where he organized hearings on the drug lag issue.* ***Page 36***

Chemical capital spending going strong

Based on first-half 1979 expenditures for new plant and equipment, outlay for full year likely will be up 13% or more over 1978 level

Capital expenditures by U.S. basic chemical producers should be doing well right now, if for no other reason than that companies are running to catch up with their planned spending at the beginning of the year.

Investment for new plant and equipment among 16 basic chemical companies surveyed by C&EN rose 8.6% during the first half of 1979 from the same period a year ago. During the first six months of 1979, the 16 companies spent more than $2.5 billion on new plant and equipment. Last year in the first half, they spent more than $2.3 billion.

The 1979 rate of spending is running well behind earlier predictions. This spring, the identical 16 companies' planned capital spending for the full year was 16.4% above actual spending in 1978 (C&EN, June 11, page 51). So for the rest of the year the companies are going to have to increase spending to meet their targets.

In the first half of 1979, the 16 companies spent 44% of the money that they had appropriated for the full year. This is a little behind the pace last year, when the same group spent 45.3% of their planned funds in the first half.

However, spending generally lags during the first half. One reason is that because of weather January and February are the two hardest months in which to build a plant.

In addition, spending is generally loaded toward the end of the year because companies rush to meet their budgets. "Industry is somewhat like the government," one industry observer comments. "If the money appropriated is not spent in one year, it is difficult for the company to get that money the next." Companies on the low end in rate of spending for the first half, such as Akzona, which has spent only 30% of its budget, and Hercules, which has spent 33%, say they are confident that they will spend the full amount for the year. And some of the companies that have spent 50% or more of their planned budgets say privately that they probably will exceed their targets because of increased spending rates in the second half.

However, in spite of their best efforts, when the final figures were tallied last year's capital expenditures by the companies did not quite match their initial targets. Although seven of the 16 companies spent more than they planned in 1978, capital spending for the group was 97.5% of first estimates.

This year, however, may be different. Despite the slow rate of spending in the first half, third and fourth quarter capital outlays are being fueled by companies' huge cash flows (earnings plus depreciation). Still rising at a fast clip, cash flow likely will do a lot to keep capital spending going through the rest of the year.

Overall, the percentage of budgets actually spent could be more than last year's 97.5% for all of 1979. If so, capital expenditures probably will increase for the full year 13% or more, although initial budgets of the 16 firms rose only 11.8% from 1978.

William Stork, C&EN New York

Capital spending increased 8.6% in first half; spending was 44% of 1979 budget

$ Millions	1st-half capital spending 1979	1st-half capital spending 1978	% change	Planned spending 1979	Planned spending 1978	% change	% of initial budget spent in 1st half 1979	% of initial budget spent in 1st half 1978	% of initial budget spent in full-year 1978	% of actual 1978 spending in 1st half
Air Products[a]	$112.2	$68.3	64.3%	$230	$170	35.3%	48.8%	40.2%	118%	34.2%
Akzona	18.4	16.4	12.2	61	40	52.5	30.2	41.0	106	38.7
Celanese	126	104	21.2	245	230	6.5	51.4	45.2	108	41.9
Diamond Shamrock	126.8	169.1	−25.0	250	300	−16.7	50.7	56.4	95.6	59.0
Dow Chemical	527	476	10.7	1200	1100	9.1	43.9	43.3	97.7	44.3
Du Pont	434	402	8.0	1000	800	25.0	43.4	50.3	98.2	51.1
Ethyl	52.5	51.4	2.1	105	100	5.0	50.0	51.4	95.8	53.7
FMC	118.2	67.4	75.4	230	170	35.3	51.4	39.6	113	35.1
W. R. Grace	119.8	116.3	71.8	450	280	60.7	44.4	41.5	98.3	42.2
Hercules	48.1	71.3	−32.5	145	115	261	33.2	62.0	101	61.6
Monsanto	235.3	264.0	−10.9	575	525	8.7	40.9	50.3	91.4	55.0
Olin	78.5	66.4	18.2	163	200	−18.5	48.2	33.2	81.3	40.9
Pennwalt	34.6	23.9	44.8	68	55	23.6	50.9	43.4	113	38.6
Rohm & Haas	27.4	36.8	−25.5	73	80	−8.8	37.5	46.0	83.0	55.4
Stauffer Chemical	97.8	89.5	9.3	188	190	−1.1	52.0	47.1	106	44.5
Union Carbide	355.0	290.1	22.4	725	750	−3.3	49.0	38.7	91.7	42.2
TOTAL	$2511.6	$2312.9	8.6%	$5708	$5105	11.8%	44.0%	45.3%	97.5%	46.5%

Note: Capital expenditures are monies spent on new plant and equipment. a Figures for Air Products are for first two quarters of fiscal 1979.

World polyurethane use heads for 7 billion lb

Key to plastic's gains is energy conservation push—rigid foams as building and vehicle insulation, flexible foams to lower auto weight

Use of polyurethane resins worldwide will be just under 6.6 billion lb in 1979 and may exceed 7 billion lb in 1980. Of the total, 62% is in the form of flexible foam, 23% is rigid foam, and 15% is elastomeric or other types. Major markets continue to be housing and motor vehicles.

Throughout global polyurethane markets, a common impetus for growth has come from energy conservation. The renewed rise of the world oil price has pushed demand for low-density rigid polyurethane foams to insulate buildings, railcars and trucks, heated pipelines and tanks, and liquefied natural gas tankers. On another front, cars made in or for export to the U.S. often have urethane elastomer bumpers to meet U.S. impact-damage regulations.

In addition, auto makers in all countries are increasing the use of energy-saving deep seating—flexible foam molded into single seat units rather than made around metal frames. Meanwhile, the use of flexible foam for furniture seating and mattresses, which grows at a mature 5% per year in industrial countries, is increasing at 10% annually in developing countries.

This global market picture for polyurethane—flexible, rigid, and elastomeric types in construction, transportation, furniture, and bedding—was presented earlier this month at Kunststoffe, the West German plastics exposition in Dusseldorf, by marketing research manager Peter Manno of Upjohn's polymer chemicals division, LaPorte, Tex.

The U.S. accounts for about 40% of world polyurethane use, according to Manno's figures. Of the 2.4 billion lb U.S. market in 1979, 59% is in flexible foams, 25% in rigids, and 16% in elastomeric and other types. The total is up 7.5% from 1978.

Housing is a major U.S. polyurethane market. Of the total 2.4 billion lb U.S. market, 345 million lb goes for building insulation. Although the slowing economy and record high interest rates may have reduced housing starts to an annual rate of 1.5 million, government minimum insulation regulations and tax rebate programs are still producing a 15% growth in polyurethane insulation over 1978.

In an analysis of the 1979 insulation market, Mobay Chemical finds that roofing is the principal use for polyurethane foam. Contractors surveyed told Mobay that 50% of their jobs were for reroofing, 17% for new roofs, and 15% for walls.

The 570 million lb of polyurethanes used in autos in 1979 will be only 1.2% more than in 1978, Manno says. A 23% increase to 80 million lb in elastomers for bumpers and interior parts will be more than offset by a 3.2% decrease in larger-volume flexible foam to 400 million lb for seating, he predicts. The main reason is lowered auto production this year, perhaps 8.7 million cars, many of a smaller size.

The decreased number of U.S. housing starts in 1979 will result in only a 5% increase to 545 million lb in use of flexible foam for furniture seating. In mattresses, a trend to trading up in quality will spark a 10% growth to 170 million lb in this use.

In Canada, whose economic troubles preceded those of the U.S., auto makers may take only 58 million lb of polyurethanes in 1979, about level with 1978. Furniture and bedding use likewise will remain at about 50 million lb, he says. Energy saving will trigger a 20% increase to 23 million lb in building insulation foam however. Overall, Manno estimates total Canadian polyurethane demand at 175 million lb, up 8% from 1978.

Among Latin American countries, Argentina, Brazil, Mexico, and Venezuela account for 86% of the 390 million lb of polyurethanes consumed in that region in 1979, up 10% from 1978. Manno expects an 8% growth in 1979 to 61.2 million lb of polyurethane for auto manufacture in Latin America, spurred by moderation of inflation in Argentina and Brazil. Brazil, which leads in auto production, will use 42 million lb this year.

Though use of polyurethane building insulation in Latin America will rise 18.6% to 28 million lb in 1979, this is far less than the apparent market in the region. Manno ascribes this low volume partly to use of brick and stone as major construction materials, neither of which is well suited to insulating with polyurethane.

Flexible polyurethane foam for furniture will grow 7% to 90 million lb, he estimates. This amount also is much less than market potential because of relatively low consumer income and division of furniture manufacture among many small shops, which have not adopted polyurethane seating. On the other hand, bedding uses will rise 8.7% to 105 million lb, spurred by increased market penetration and trading up to better quality mattresses.

The West European urethane market will be 1.80 billion lb in 1979, rising 4% to 1.87 billion lb in 1980. Eastern Europe will use 300 million lb in 1979 and 10% more or 330 million lb in 1980, Manno predicts. East-West differences in auto-making technology are reflected in the use of 512 million lb of polyurethane for West European cars in 1979, compared with only 2.6 million lb in East European countries. The slowing U.S. economy will limit demand for exported West European cars, though European demand will rise somewhat. The result will be West European consumption of 521 million lb of polyurethane in 1980 autos, East European consumption of 3.1 million lb.

Western Europe will use 237 million lb of rigid foam in building insulation in 1979 and 250 million lb in 1980, Manno says. The growth rate could increase if countries other than West Germany adopt minimum insulation standards. In Eastern Europe, 95 million lb will be used for insulation in 1979 and 108 million lb in 1980.

Polyurethane mattresses will use 412 million lb of flexible foam in Western Europe in 1979 and 430 million lb in 1980. Manno ascribes this low 4% growth to insufficient sales efforts by producers.

By contrast, polyurethane mattresses, because they cost less than mattresses made of other materials,

Global urethane market will top 6 billion lb in 1979

NORTH AMERICA

Millions of lb	Flexible and rigid
Transportation	628
Construction	414
Furniture, Bedding	803
Other[a]	773
TOTAL	**2618**

WESTERN EUROPE

Millions of lb	Flexible	Rigid
Transportation	461.1	51.3
Construction	—	232.8
Bedding	412.8	—
Furniture	380.7	19.4
Other[a]	91.2	149.6
TOTAL	**1345.8**	**453.1**

EASTERN EUROPE

Millions of lb	Flexible	Rigid
Transportation	2.6	—
Construction	—	94.7
Bedding	138.8	—
Furniture	41.0	5.5
Other[a]	2.6	16.5
TOTAL	**185.0**	**116.8**

ASIA

Millions of lb	Flexible	Rigid	Other
Transportation	150.8	11.9	11.7
Construction	—	38.3	—
Bedding	96.9	—	—
Furniture	101.8	6.8	—
Other[a]	105.1	112.9	139.0
TOTAL	**454.6**	**169.9**	**150.7**

SOUTH AMERICA

Millions of lb	Flexible	Rigid	Other
Transportation	56.4	4.8	—
Construction	—	28.0	—
Bedding	104.6	—	—
Furniture	89.2	—	—
Other[a]	30.8	15.9	59.5
TOTAL	**281.1**	**48.7**	**59.5**

AFRICA

Millions of lb	Flexible	Rigid
Transportation	1.1	1.3
Construction	—	10.1
Bedding	89.2	—
Furniture	6.6	0.2
Other[a]	2.2	7.9
TOTAL	**99.1**	**19.6**

MIDDLE EAST

Millions of lb	Flexible	Rigid
Transportation	—	0.4
Construction	—	8.6
Bedding	165.2	—
Furniture	0.7	—
Other[a]	1.5	10.1
TOTAL	**167.4**	**19.2**

Note: Middle East is defined here as Turkey, Syria, Lebanon, Jordan, Israel, Cyprus, Kuwait, Iran, Iraq, Saudi Arabia, and Egypt.
a Includes appliances, foundry core binders, carpet underlay, fibers, footwear, textile laminates, and packaging. **Source:** Upjohn Co.

are increasingly popular in Africa and the Middle East. Manno predicts that 165 million lb of flexible foam will be used in the Middle East in 1979 and 176 million lb in 1980. Consumption in Africa will be 89 million lb in 1979 and 99 million lb in 1980. East European use will grow from 138 million lb in 1979 to 145 million lb in 1980.

Continued new housing construction and family formation in Western Europe will produce a growth in flexible foam furniture seating to 380 million lb in 1979 and 388 million lb in 1980. As in the U.S., furniture makers continue to rely on wood, taking only 19 million lb of rigid foam in 1979 and 20 million lb in 1980.

Eastern Europe will use 47 million lb of flexible foam for furniture in 1980, up from 41 million lb in 1979, whereas rigid foam will be 5.5 million lb for both years. Flexible foam furniture consumption will be 660,000 lb in the Middle East in 1979 and 1980. African countries will use 6.6 million lb of rigid and 220,000 lb of flexible foam for furniture in both years.

Molding of polyurethane elastomer shoe soles is an industry that has gravitated from Western Europe to Eastern Europe and the Middle East in recent years, Manno says. Countries in these regions will use 198 million lb of polyurethane for shoe soles in 1979 and 211 million lb in 1980.

Turning to Asian markets, Manno says that Japan uses 66% of the 775 million lb of polyurethane resins produced in Asia and the Pacific region. He estimates 1979 Japanese car and truck production at 10 million units, with more than half of these exported to the U.S.

Manno expects that the Japanese auto industry, as in Western Europe, will suffer from weakness in the U.S. economy. Thus, flexible foam use in Japan's auto industry could drop from 135 million lb in 1979 to 131 million in 1980. On the other hand, increasing use of reaction injection molded (RIM) polyurethane elastomers for fenders and bumpers could raise elastomer consumption to 14 million lb in 1980 from 10 million lb in 1979.

Rigid building insulation foam will take a relatively low 32 million lb share of the Japanese market in 1979, increasing to 35 million lb in 1980. These small use levels persist, Manno says, despite the Japanese government's offer of low-interest loans for installing insulation.

Furniture and bedding are slow-growing but stable markets in Japan, Manno adds. The 86 million lb-1979-use level could increase to 89 million lb of flexible polyurethane foam in 1980.

Overall, Japanese polyurethane use likely will increase from 529 million lb in 1979 to 561 million lb in 1980, Manno says.

Statistics are not readily available from the People's Republic of China, but Manno estimates that current use of rigid foam is 11 million lb and of flexible, 8.8 million lb.

Total polyurethane markets in Australia and New Zealand will be 112 million lb in 1979 and 120 million lb in 1980. Among other Asian countries—South Korea, Taiwan, the Philippines, Hong Kong, Thailand, Singapore, Indonesia, and India—183 million lb of polyurethanes will be used in 1980, up from 161 million lb in 1979.

Australia and New Zealand will use 16 million lb of polyurethanes in autos in 1979 and 1980. Other Asian countries, whose combined auto production is about 330,000 per year, will use 13 million lb in 1979 and 16 million lb in 1980.

Bedding will take 14 million lb of flexible polyurethane foam in 1979 in Australia and New Zealand and almost 16 million lb in 1980. Among other Asian countries, South Korea and Taiwan are the main users of polyurethane foam for mattresses. □

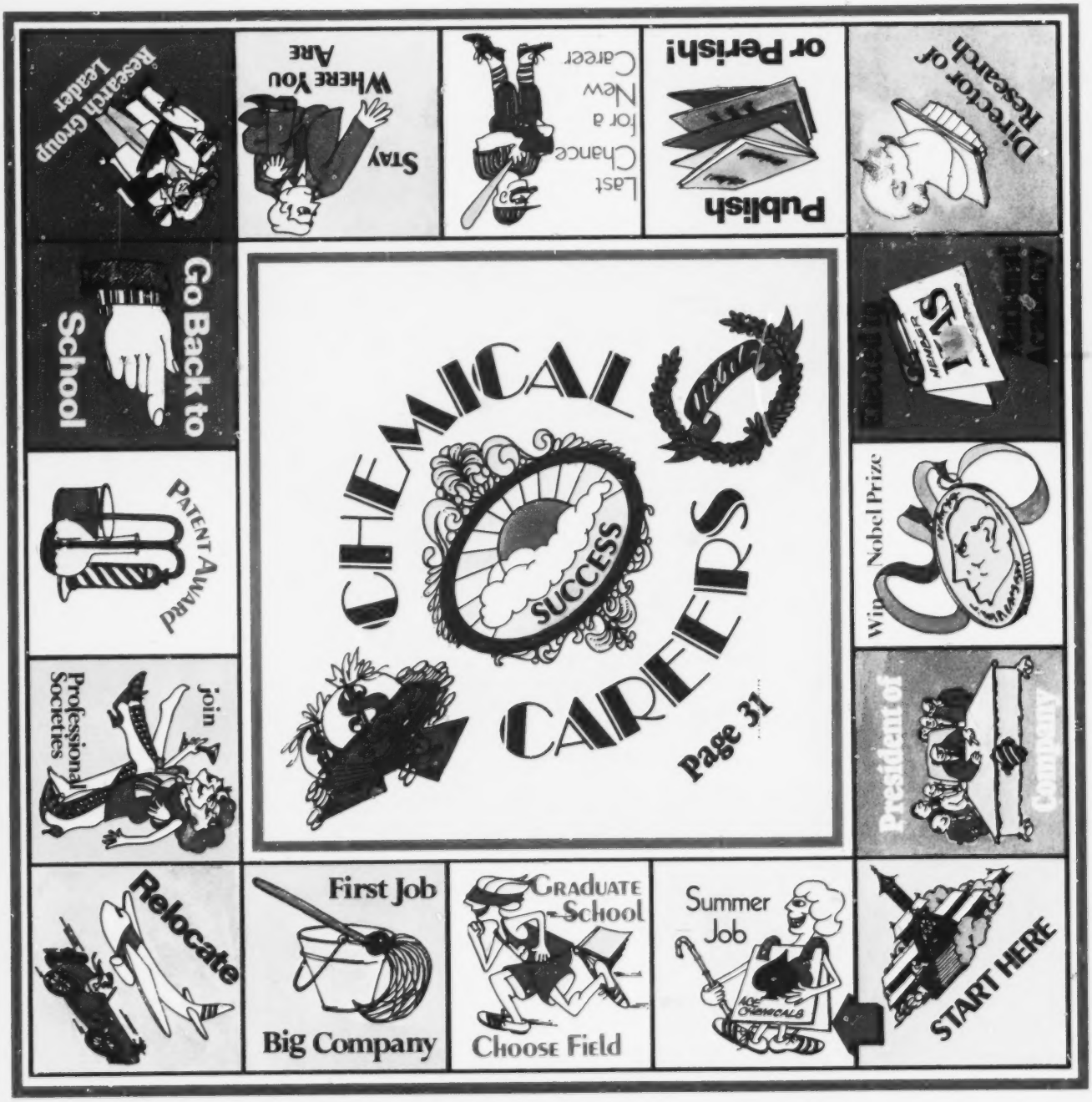
OCT

22

1979

Chemical & Engineering NEWS
October 22, 1979

Petrochemically stones top submillimeter range Page 23



October 22, 1979
Volume 57, Number 43
CENEAR 57 (43) 1–84
ISSN 0009-2347

Chemical & Engineering NEWS

Cover: John V. Sinnett

4 Letters

Concentrates
10 Business
17 Government
20 Science/Technology

The Departments
61 New Products
63 Meetings
84 Newscripts

News of the Week

- ***Nobel Prize in Chemistry*** *is awarded to organic chemists Herbert C. Brown of Purdue University, and Georg Wittig of Heidelberg University.* **Page 6**
- ***Long-term exposure of groups of rats and mice*** *to formaldehyde apparently has resulted in cancer of the nasal passageway of some male rats, but not mice.* **Page 7**
- ***American Cyanamid is fined $10,000*** *for its management policy that allegedly forces women to be sterilized in order to keep their jobs.* **Page 7**
- ***Radio-frequency electric fields*** *are used to heat deposits of shale oil in Texaco's new process; eliminates mining, retorting, and waste disposal problems.* **Page 8**
- ***New process for making ethylene,*** *called Thermal Regenerative Cracking, limits carbon laydown and promises increased flexibility and lower costs.* **Page 8**

Business

- ***American Cyanamid looks to its research*** *and development buildup in the 1970's, especially in the life sciences, to produce expanding business and rising profits in the 1980's.* **Page 12**

International

- ***With U.S. chemical exports*** *soaring to Europe; chemical industry, political leaders there complain that U.S. oil, gas controls are indirect subsidy for petrochemical firms; U.S. firms marshal rebuttal.* **Page 14**

Government

- ***House Committee cites EPA's failure*** *to meet deadlines on hazardous waste disposal, lethargic enforcement; EPA counters with successes.* **Page 18**
- ***High Court weighs*** *OSHA benzene exposure case; decision may determine point at which federal agencies must consider economic impact of their rules on the regulated industry.* **Page 19**

Science

- ***Bell Telephone Laboratory scientists*** *open submillimeter region to astrochemists—using a refined InSb bolometer, aboard NASA's airborne observatory, to detect interstellar neutral carbon.* **Page 23**
- ***Frequency measurement*** *of specific yellow lines in absorption spectrum of iodine molecule is highest to date; offers new definition of length standard.* **Page 25**

1980 Employment Outlook

Survey of the job outlook *includes reports on the demand for chemists, salaries of chemists, and career guidance information. Recommendations are given on how to improve one's chances of career success.* **Page 31**

Books

- ***Physician argues that toxic hazards of fluorides*** *in water outweigh their dental health benefits, citing his clinical studies of patients to bolster argument.* **Page 56**

1980

EMPLOYMENT OUTLOOK

Career Opportunities for Chemical Professionals

Although the health of the overall U.S. economy increasingly is coming into question, employment prospects for chemists and chemical engineers still look strong. All signs indicate that employers are at least as active as they were last year in seeking job candidates. And last year was a relatively healthy year for hiring. If anything, this year is even better.

At the latest ACS national meeting, for example, the number of employers with jobs to offer was up about a third. Help-wanted ads in C&EN are running at a higher level now than at any time in more than a decade. And unemployment among chemists, at a rate of 1.1% as of last March, is the lowest since ACS began to measure the employment status of its members in 1971.

Campus recruiting also is holding up well. College placement officials say that as many or more employers seeking new graduates showed up at their schools this year as last. And although some fingers may be crossed, they claim that they see no signs yet of a cutback in interviewing during the year ahead.

Meanwhile, employers of chemists and chemical engineers tell C&EN that they expect to have 2% more chemists and 3% more engineers on their staffs next year than they did in 1979. About 65% of the chemists and 80% of the engineers they expect to hire in 1980 will be new graduates.

These developments and other information pertaining to careers in the field of chemistry are detailed in C&EN's most recent survey of the employment outlook, as reported on the following pages by senior editor Howard J. Sanders.

How to succeed

Success in chemistry depends on making a lot of right decisions. Each individual must choose his own goals and set his own course. But C&EN has asked chemists who already have made their mark in the field for tips on how to get ahead in a chemical career. **Page 32**

Demand

Opportunities for chemists and chemical engineers continue to look bright, as employers remain active in the job market. The pace of campus recruiting shows no sign of slackening. And unemployment among chemists is at the lowest level in a decade. **Page 40**

Salaries

Chemists and chemical engineers are earning more this year. Starting salaries being offered new graduates are well above those of a year ago. But with inflation running rampant, salaries have not been keeping up with living costs, at least for experienced chemists. **Page 46**

Career Planning

A wealth of valuable information and services on chemical careers is available from the American Chemical Society and other organizations. A directory provides names and addresses of many employers of chemists and chemical engineers. **Page 48**

HOW TO
1980
SUCCEED

Chemists offer practical advice on mapping a successful career

So you want to suceed in chemistry. A bachelor's degree with a major in chemistry is needed for openers, of course. But what's your next move? Graduate school, or look for a job? And, in either case, do you aim for a big organization or a small one? What about getting out of the lab and into other types of chemically related work? Or moving to a new location? Can playing company politics give you a leg up? Or publishing papers as often as possible?

Succeeding in chemistry clearly is not a one-decision undertaking. To get some ideas as to how a chemist might improve the chances for success, C&EN has talked with men and women who have made their mark in chemistry. Their views provide a variety of insights into how success may be achieved.

Getting a good, solid grounding in chemistry during college, of course, is essential. Should this be done at a large school or a small one? Many chemists say that it makes no difference. Small schools may not have the high-powered laboratory equipment found in many large universities, but this does not affect the quality of undergraduate training significantly.

One chemistry professor observes, "Thanks to federal research support, many small chemistry departments are a lot better equipped these days than in the past. Besides, the quality of a chemical education depends more on the caliber of teachers than on the sophistication of instruments—particularly at the undergraduate level."

Many faculty advisers recommend that students attend a large university if they prefer a wide variety of courses and a broad range of extracurricular activities. They also recommend a large university to students self-sufficient enough to cope with its relatively impersonal atmosphere.

On the other hand, faculty advisers usually suggest a small college to students who would feel lost on a large, teeming campus. They also point out that a small college offers more individualized instruction.

As for graduate chemistry, most scientists recommend a large school with a highly regarded research faculty. Such schools, they believe, are definitely superior.

Another important question is: How advanced a degree should a person get? To teach chemistry in a university or college, a Ph.D. degree is virtually essential. It also is imperative for the chemist who wants to do research, especially basic research. Says one chemist, "Since most chemists seeking employment as researchers have Ph.D. degrees, a person lacking such a degree is at a serious competitive disadvantage."

Many observers believe, however, that, for production, sales, market research, technical service, or relatively routine laboratory work, a B.S. or M.S. is adequate. Any additional training a person may need can be obtained on the job or through continuing education courses.

Robert A. Alberty, professor of chemistry and dean of science at Massachusetts Institute of Technology, recommends that college students participate as much as possible in such extracurricular activities as clubs and athletic teams to improve their skills in working with other people. "Such skills," Alberty says, "can be of enormous value in later life."

How important are academic grades in determining a person's later professional success? Answers vary. Samuel P. Massie, chairman of the chemistry department at the U.S. Naval Academy, declares, "Good grades help to open doors when you are looking for a job. Employers tend to give appreciable weight to grades in evaluating job applicants because grades are a measure of whether a student has made an effort to develop technical as well as general scholastic competence. Employers, of course, also consider other factors, such as motivation, personality, initiative, creativity, and so on. Obviously, grades aren't everything."

But Alberty observes, "Academic grades can be grossly overrated. Some people are just good test-passers, possibly because they have good memories. They cram for exams and are adept at repeating almost verbatim on tests what their professor said in class. Such a student may get terrific grades. But by blindly accepting everything the professor says, the student may show a lack of judgment and the ability to think independently—talents that will be extremely important in later life. Admittedly, good grades are of value in getting into graduate school and in getting a job. In the long run, however, there are much more important things."

Summer jobs in chemistry, either in industry or at a university, may increase chances of later success. Such work will help to make studies more relevant to future careers. It also provides a clearer idea of what professional work will be like. Moreover, chemistry students who work in industry during the summer probably will find it easier to get permanent employment in industry when they graduate because of this experience.

A summer job also may help a student to decide in which area of industry to work—or, on the other hand, to conclude that a career in industry is definitely out.

Attending universities or colleges having chemistry departments that offer coop programs also has advantages. One professor observes, "Such programs, which alternate periods of study with periods of on-the-job experience, increase a person's chances of later professional success. They give the student valuable work experience and exposure to the practical world. Also important to many students, the pay helps defray part of the cost of their college education."

Alberty of MIT states, "One way to get increased benefit out of your college experience is to develop a friendship with at least one member of the chemistry faculty. This person can serve as a valuable role model for

you—someone whom you can emulate and who can enhance your own chances of success."

If a graduate ultimately wants to be a chemistry teacher, should he or she first work in industry for several years to gain professional experience? (Many industrial critics complain that a major shortcoming of chemical education is that few chemistry professors have had any exposure to the practical world of industry, even though most of their students will later work in industry.)

Most university chemists say, however, that a person who wants to teach should do so immediately after graduation or postdoctoral studies. They argue that time spent in industry prior to a job in academia is "essentially lost time" that might better be spent in teaching and academic research, partly because these are among the most creative years of a chemist's life. And from a competitive standpoint, people who work in industry will start behind their contemporaries in academic experience and in obtaining tenure.

Some chemistry departments, however, recognize the value of industrial experience for faculty. They urge staff members to take three to 12 months off to work in industry. This type of program is encouraged by some chemical firms that temporarily hire faculty members to acquaint them with industry.

It also is encouraged by the National Science Foundation's Science Faculty Professional Development Program, which was started in 1976 to provide financial support to between 80 and 100 university science teachers a year to work for limited periods of time in industry (in some cases, these teachers work in schools other than their own).

In selecting a company to work for, should a graduate pick a large company or a small one? Most observers believe it preferable for a chemist to work first for a large firm because a large company provides a better learning experience.

James D. D'Ianni, former assistant to the vice president of research at Goodyear Tire & Rubber Co. and now president-elect of the American Chemical Society, says, "When you work as a laboratory chemist for a large firm, you are apt to deal with a broader range of research problems because the company is more diversified. You are likely to have better equipment to work with. If you run into difficult research problems, you have a greater number of expert, in-house scientists to turn to for assistance. Moreover, in a large company, you are more apt to learn about the latest, most efficient ways of doing things. All this is part of a valuable learning process for the beginning chemist and can increase considerably his or her chances of getting ahead in the professional world."

C&EN staff photo

Niederhauser: a company that has a growing commitment to R&D is a better firm to work for than one whose R&D spending fluctuates with its economic fortunes

Of course, working for a small company has advantages. You may be promoted to a responsible position sooner. The results of your laboratory efforts may be commercialized more quickly. You may have greater freedom of action. Says one chemist, "If you like to be fairly independent, you may be happier working in a small organization."

Warren D. Niederhauser, director of pioneering research at Rohm & Haas, says, "As far as I am concerned, the most important factor in choosing a chemical company to work for is not the size of the company but its growth prospects. How fast you advance can depend on how rapidly your company advances." He recommends that chemists considering employment with a firm study its recent annual reports. He also suggests discussing its business prospects and the quality of its top management with a knowledgeable stock broker.

Niederhauser also urges chemists to consider a company's record on research and development spending. A firm that has a strong and growing commitment to R&D is a better place to work than one whose R&D spending fluctuates with its economic fortunes. He further cautions, "Be wary of companies that have periodic, large-scale layoffs of technical personnel."

In some chemists' view, one of the best ways to get ahead is to change jobs relatively often. Some, in fact, flatly declare that all chemists wishing to improve their financial status should change jobs at least once within the first three years of entering the profession. They argue that no company will appreciate your services or compensate you as much as will a new employer.

Many chemists, however, regard such reasoning as hogwash. The value of job-hopping, they say, has been grossly misrepresented.

Esther A. H. Hopkins, a senior projects administrator at Polaroid, says, "Of course, if you and your boss are constantly at loggerheads and your working conditions are abominable, you obviously should change jobs—and the sooner the better. But certainly do not change jobs merely to increase your salary. If you like the work and feel you have a good future with your organization, stick with it. Too many people change jobs to gain tempting but very short-term advantages."

Says Blaine C. McKusick, assistant director of Du Pont's toxicology laboratory, "People who switch employers a great deal may be regarded as using their jobs merely as stepping-stones. After three or four switches, it may look like a person can't make up his mind about what he wants to do. If you are primarily interested in changing employers to increase your income, your new salary

should be at least 30% higher than the old one. In any event, don't change jobs on the theory that this is the only way to get ahead."

Some observers point out that most organizations today have a policy of promoting from within. Thus, employees do not have to leave to get a promotion. More companies recognize that such a policy can reduce the loss of valuable employees.

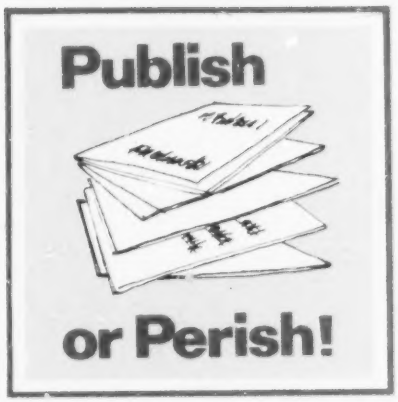
In 1977, ACS surveyed its members to find out what effect repeated job changes have had on their salaries. The results showed, surprisingly, an inverse relationship between number of employers and salary at all degree levels and most experience levels.

In 1977, the mean annual salary of full-time-employed ACS members with B.S. degrees and 20 or more years of professional experience was $28,713 for those who had worked for only one employer, but $27,017 for those who had worked for four. The mean annual salaries were $38,392 for Ph.D.'s with only one employer but $32,062 if they had had four employers.

The survey suggests that chemists who change employers relatively often may lose the seniority needed to advance into high-paying positions. Large, well-established employers also may be leery of hiring job-hopping chemists because they are viewed as unstable or as having been eased out of former jobs because of incompetence.

Patricia A. M. Figueras, a chemist who is head of computer and financial services at Eastman Kodak Research Laboratories, emphasizes that chemists should be flexible in terms

McKusick: people who switch employers a great deal may be regarded as using their jobs merely as stepping-stones to employment elsewhere



of the jobs they are willing to tackle. Some people who go into industrial research, she says, want to spend their professional lives continuing the research they did in graduate school. "That's no way to get ahead," she comments. "After all, the time may come when your company no longer has an interest in the type of research you are doing because its business activities have changed."

She urges chemists to be open to new opportunities—to take on research in the polymer area, for example, even if their previous experience has been with agricultural chemicals. The new job will require a rapid education in the polymer field, but the experience should expand your scientific horizons.

Many scientists advise those who start out in a research job to be willing to take on an entirely new assignment outside the laboratory. This might be in market research, sales, personnel work, toxicology, industrial hygiene, technical service, or whatever.

To succeed, should you feel obliged to accept a new job in the organization if it will require you to move to a new location? Many observers say that, unless you have some overriding personal reason for not wanting to move, you certainly should.

In most cases, the move will be a promotion, as well as a stepping-stone to a higher position later, since it will broaden a person's outlook and experience.

Ellis K. Fields, a research consultant at Amoco Chemicals, says "By all means, be willing to move if your supervisor wants you to. After all, the more you please your boss, the more likely he is to please you."

Some people say that an employee runs the risk of damaging his or her prospects by turning down a transfer more than once. Superiors may interpret this to mean that other interests have higher priority than his or her professional career.

Of course, changing jobs and locations in a company can have its hazards. Some years ago, a chemist reluctantly transferred to a position as manager of a company division that was in financial trouble. When the shaky operation collapsed, much of the blame was unfairly leveled against him. As a result, his professional career suffered irreparably.

Success, of course, depends on good work habits. That means, in part, the ability to work hard. It also means being willing to work overtime to complete a job.

Fields of Amoco says, "A chemist, of course, is not expected to work routinely 14 hours a day, seven days a week. Supervisors realize that a person has responsibilities not merely to a job but also to family, community, and other interests. However, when the need arises, one should be willing to put in extra time. And one should do this not because a supervisor insists on it but because of an eagerness to complete work properly and on time. People who succeed are not clock-watchers."

Niederhauser of Rohm & Haas points out, "To succeed as a research chemist in industry, you need to be productive. The people who get ahead are the ones who contribute most to the company by being the most creative. Obviously, a chemist must exercise good judgment in selecting research goals and the ways to achieve them. At the higher levels of management, this requires both good scientific judgment and good business sense."

Many scientists emphasize the need to develop laboratory skills. For example, Fields of Amoco cautions, "In your research projects, don't collect reams of meaningless data. Un-

Figueras: chemists should welcome new job opportunities in a company because they can be intriguing and challenging and can expand a person's scientific horizons

fortunately, computers make that all too easy to do these days. By all means, don't use a computer as a substitute for thinking."

Work should be planned. Fields recommends that, every working day, chemists write down the things they hope to accomplish tomorrow. Although few people follow such a formal procedure, they do look ahead to what they should be doing tomorrow, next week, or next month.

David C. Young, a senior research specialist at Dow, comments, "An excellent work habit is to assign priorities to your work so that you get the most important things accomplished. Don't get bogged down in minutiae. And be sure to budget your time so that you meet deadlines."

David R. Lide Jr., a chemist who is chief of the National Bureau of Standards' Office of Standard Reference Data, says, "Good chemists know to stop working on a project when they can use time better on some new undertaking. They do not milk a project merely to achieve some small additional benefit. Good chemists halt a project when it becomes clear that further effort will be fruitless. On the other hand, they must be willing to persist in a task even in the face of repeated failure and disappointment. Of course, deciding when to stop a project is always difficult."

A good work habit, say many chemists, is to do the hardest jobs first and save the easiest ones for last. Too many people do just the opposite—and make their work more difficult and less productive. For many people, that means doing the hardest job at the start of the workday, when the mind is clearest and less cluttered.

Mary E. Carter, head of USDA's Southern Regional Research Center, recommends, "Do your hardest jobs when you know by experience that you perform your best work, which is not the same time for everybody. Some people work best right after lunch."

W. Thomas Lippincott, professor of chemistry at the University of Arizona, urges chemists to go off periodically to some isolated place where they can devote themselves totally to serious scientific thought—away from the telephone, laboratory hubbub, gossip with coworkers, and other distractions. "To be creative," he says, "you sometimes have to focus your attention solely on chemical problems and forget all others."

Apart from having good work habits, most successful chemists also work well with other people, are well liked, and are willing to spare the time to be helpful to others. This is not universally true; some outstanding chemists have less than glowing personalities. Says Young of Dow, "Functioning well with other people as a method of getting ahead professionally means not only getting along on a friendly basis with people above you but also with those on the same level or below you—everyone from chemists, production workers, and technicians to electricians, pipefitters, and laboratory dishwashers. It is not only a matter of decency; your success depends on their continuing cooperation. You can't make adequate progress in your own work unless you are on friendly terms with all of the people whose help you need."

Milton Harris, a former director of research who is now a government and university adviser, says, "Most successful chemists, especially those who direct the work of others, are people-oriented. In other words, they have a sympathetic understanding of the needs and aspirations of other people."

USDA's Carter says, "I believe being people-oriented is more important among managers than among laboratory chemists. Lab chemists generally have fewer dealings with people. A lab person has to be primarily research-result-oriented. Some quite creative scientists are basically loners. Their ideas, therefore, often have to be carried forward by other research workers."

Discussing desirable personality traits, Kodak's Figueras says, "One thing I find important is the need to be patient with the people you work with. You should realize that not everyone will do a job as fast as you can, or will do it in the same way. You should give people the freedom to do a job in their own way—within reason, of course. Otherwise, you run the risk of frustrating and antagonizing people."

Lide of NBS comments, "A successful chemist understands the strengths and weaknesses of people and makes the greatest use of their strengths. In many cases, you do not have the freedom to select all of the people who work for you. Thus, you must make a very careful effort to use the people available to you in the optimum way."

One chemical executive observes, "Good scientists, as well as good managers, understand a problem quickly. They get to the heart of the problem and don't waste time with extraneous details."

Carter of USDA says, "Successful chemists develop the habit of thinking innovatively. They are not content to continue doing things in the same old ways. They also are open to the new ideas of others."

People who are successful also have marked ambition. They succeed because they have a driving desire to achieve their goals. But Lide comments, "Having driving ambition does not mean that you have to be ruthless. The drive is within yourself; it is not necessary to ride roughshod over other people. Some of the most successful chemists I know are exceptionally humane, gentle, and self-effacing people. Yet they are highly ambitious and have a keen desire to succeed."

Is playing office politics—by deliberately ingratiating oneself with one's superiors to gain special favors or promotions—a factor is achieving success?

Says Harris, "Human nature being what it is, I believe that office politics is a factor in just about every organization. However, I don't think it is nearly as important among chemists

Success can be measured in many ways

Success is a highly personal matter. How one person measures it may be of little or no consequence to another.

Doubtless, the most widely used indicator of success is a person's income and the value of his possessions. Says one industrial chemist, "Since money is such a frequent measure of success, rarely will a person turn down a job that will increase his salary substantially. He may worry that the position will give him an ulcer, but he usually will accept it anyway."

Other people measure success primarily by how much they enjoy their work. If they like their jobs, salary is strictly secondary—as long as it is adequate. Lester C. Krogh, vice president of 3M's commercial chemical division, declares, "No salary is high enough to compensate you for doing a job that you thoroughly dislike."

Many scientists measure success chiefly by their professional accomplishments. This often is reflected in the number of their publications and patents, as well as lectureships and awards.

Another indication of success is the esteem of associates, as evidenced by how often they seek you out for your knowledge and judgment or appoint you to advisory boards.

Other people gauge success in terms of power—the ability to control the lives of others or to influence decisions and change the course of events.

In other words, each person defines success in his own way.

as among other people in industry. Scientists tend to be promoted primarily on the basis of their technical competence and other qualifications."

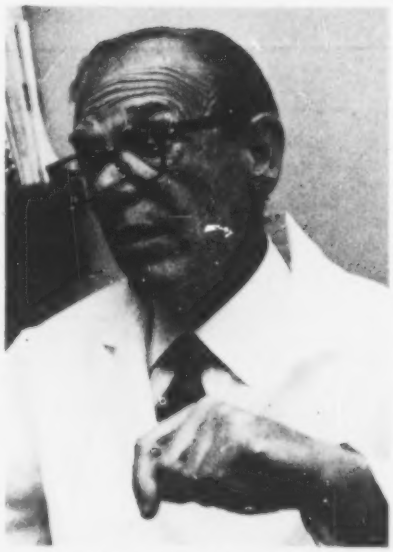
An industry executive comments, "If two people have equal qualifications for a job, it is only natural for you to promote the person you know best and like the most. What's wrong with that?" Another observer retorts, "Yes, but how often are two people equally qualified? The problem with office politics is that less-qualified people often are promoted because they have curried favor with top managers. Most chemists are promoted because of their abilities, however, and not because they have cozied up to the 'right people.'"

To increase his or her chances of success, a chemist should keep scientifically up-to-date by reading chemical magazines, journals, and books. Many people recommend that chemists also read publications in related scientific fields. As one chemist puts it: "Sometimes, an article in a physics or biology journal can give you stimulating ideas useful in your own work." Says one company manager, "People who get ahead are those who are interested in almost everything and read very broadly."

Many chemists stress the need to attend scientific meetings and conferences to obtain up-to-date information and helpful new ideas. Also useful is the chance for informal discussions with colleagues in other organizations.

Fields declares, "I think that attendance at meetings is so important that I believe a chemist seeking a job should make sure that the organization has a liberal policy regarding participation in meetings. Such participation certainly can expand a chemist's outlook."

Scientific education obviously does not end with a university diploma. Continuing education courses are one way to keep abreast of a field. Many chemists take continuing education courses either at their company or at nearby universities or colleges. Many take ACS Short Courses or similar courses offered by other organizations.



Fields: scientists should be quite willing to put in extra time on the job whenever it is necessary, so that the work is completed properly and on schedule

Says one chemist, "Since in-depth knowledge of a field is one key to success, I am in favor of taking as many continuing education courses as possible. Many firms, of course, pay part of the cost of such programs."

A chemist's reputation can be enhanced by writing articles or books. An outstanding review article or a college chemistry textbook can lead to international fame.

Some people assume that the more articles they write the better. Others emphasize that quality is more important than bulk. Says one chemist, "Stretching into three or four papers information that could be published in one merely clutters the literature. Also, it earns for the author an unfortunate reputation for being more concerned with the number of his publications than with their value."

Chemists frequently stress the need to write and speak well. They point out that the advancement of many chemists has been impeded by their inability to convey ideas to others. A brilliant idea, if not comprehensible to others, may come to naught.

Chemists also must be able to speak in a clear and convincing manner. Also important is the need to tailor one's presentation to the audience. A talk loaded with technical jargon and abstruse scientific concepts can antagonize an audience, if not put it to sleep.

Hopkins of Polaroid says, "If you feel your writing is not as good as it should be, I'd recommend that you take continuing education courses in English and in technical report writing. I'd also urge you to read good writing regularly and analyze for yourself why it reads so interestingly and fluently."

Up to a point, a research chemist, to increase his or her salary substantially, does not need to give up a laboratory job to become a manager. A highly productive and respected chemist may not earn as much as a vice president but may well earn as much as a top research manager.

This situation has changed radically in the past 25 years. Before then, scientists often left the laboratory because they felt that the only way to get ahead was to become a manager. But some chemists who are good researchers have little or no talent for directing the work of others and thoroughly dislike doing so. They would contribute far more to their organizations if they remained in the laboratory, which they would do if they were paid more.

This led many companies to develop the "dual ladder" of advancement. One ladder is for research workers; the other is for managers.

Under this system, top researchers receive salaries and perquisites similar to those enjoyed by their managerial counterparts. Hence, many scientists no longer feel under pressure for monetary reasons to seek positions that they really do not like. Lester C. Krogh, vice president of 3M's commercial chemical division, comments, "Fortunately, because of the dual-ladder system, scientists now are able to stay where they do their best work."

Says USDA's Carter, "Many skilled chemists who have been rewarded with prestigious titles, ample salaries, and the esteem of their colleagues are quite satisfied in the laboratory. They have decided what they want to do most, and they are happily doing it. On the other hand, many chemists genuinely prefer to leave the laboratory and move up the managerial ladder. And they have done so with notable competence. Both can be said to have achieved professional success." □

Reprints of this C&EN Employment Outlook 1980 will be available at $2.00 per copy. For 10 or more copies, $1.25 per copy. Send requests to: C&EN Reprint Department, American Chemical Society, 1155–16th St., N.W., Washington, D.C. 20036. On orders of $20 or less, please send check or money order with request.

1980 DEMAND

Demand for chemists is good this year, is likely to hold up in 1980

Despite concern over the slowdown in the nation's overall economy, the employment picture for chemists and chemical engineers continues to look good. For the time being, employers seem to see little or no need to cut back their hiring of chemical professionals.

In the Employment Clearing House at the ACS fall 1979 national meeting, recruiting activity was healthy. Substantially more employers interviewed job applicants than at the fall 1978 ACS national meeting. However, because considerably more job applicants also showed up this year, the average number of interviews per applicant was less.

In March 1979, the unemployment rate among ACS members was lower than at any time in recent years. And the volume of "positions open" advertising in C&EN has been decidedly higher all this year than it was during any period of 1978.

In all, the various indicators of demand show that most employers see an expanding need for chemists and chemical engineers. Clearly, the job situation today is vastly better than it was in either of the two recessions of the early and mid-1970's.

On college campuses, for example, recruiting was at least as brisk this past year as it had been a year earlier— and the previous year itself had been a strong one compared to earlier in the decade. College placement officials, moreover, are generally encouraged about job prospects for their students. The current cloudy business climate, they claim, does not seem to be putting a crimp in employers' plans, at least to date, to look for new graduates between now and next June.

Rebecca J. Simon, placement director of the University of Illinois' school of chemical sciences, reports that 192 employers recruited at the school both in academic year 1977–78 and 1978–79 (the figure was 171 in 1975–76). Although the number of man-days that employers spent interviewing on campus dropped from 364 in 1977–78 to 309 in 1978–79, student interviews rose from 3059 to 3631.

Simon adds that the recruiting outlook for the coming months "looks good for our job candidates." Many employers who regularly recruit chemists and chemical engineers at the school already have signed up for interviewing in the coming months. Furthermore, employers who have not come to the campus in several years also have scheduled visits. "Apparently, the slump in the national economy," Simon says, "has not had much impact on the number of interview schedules requested by employers."

Jean E. Eisel, director of career services for the colleges of arts and sciences at Ohio State University, notes that 56 organizations came to interview its graduating chemists in 1978–79, up from 41 in 1977–78. Employers in the most recent academic year generally had more job openings to fill than in the previous year. "In addition, many employers," she says, "either sent more recruiters (perhaps two instead of one) to interview graduating chemists or spent more interviewing time on campus (perhaps three days instead of two)." Recruiters showed an exceptional interest in hiring B.S. chemists and a greater-than-usual interest in hiring Ph.D. chemists.

About the same number of organizations are scheduled thus far to interview Ohio State's graduating chemists in 1979–80 as was the case at this time last year. "The situation looks good now," Eisel says, "but employers, of course, can always cancel out. Obviously, there is considerable concern about the possible effects of a further downturn in the economy."

At the University of North Carolina, Chapel Hill, 34 employers came to recruit chemists in 1978–79, four more than in 1977–78. Joseph M. Galloway, director of the university's placement office, notes a definite improvement in the past year in the demand for chemists, "spurred by the need to solve the nation's energy and pollution problems, improve industrial processes, and develop new chemical products."

He adds that "employers are trying to make up for the slowdown in their hiring of chemists in the early 1970's. Moreover, since companies now are making relatively high profits, they have more money to spend on R&D."

At the University of Wisconsin, 76 employers interviewed graduating chemists in both 1977–78 and 1978–79. This past academic year, employers had an unusually large number of job openings, says Audrey L. Aylesworth, the school's chemistry placement coordinator. Some who

Recruitment advertising hits new high

Volume of C&EN "positions open" advertising,[a] column-inches

a Total volume of "positions open" advertising in four consecutive issues of C&EN ending with the issue specified. No issues were published in the last week of December 1976, 1977, and 1978.

originally planned to spend only two days on campus recruiting chemists ended up spending three.

The employment outlook for Ph.D. chemists appears to be improving, she reports. The university's 23 Ph.D. chemistry graduates who accepted industrial positions in 1978–79 received a total of 62 job offers—about three per graduate. "In 1975," she comments, "if a Ph.D. chemist got one offer, he felt extremely fortunate." The employment picture for graduating B.S. chemists at the University of Wisconsin also is good. "Last year, our average job-hunting B.S. chemist," she estimates, "received about two offers."

Aylesworth further points out, "I expect a good recruiting year in 1979–80. We are getting lots of inquiries from employers and, to date, have had no cancellations of interviews. Fortunately, we have yet to see any effects of a business setback."

At the University of California, Berkeley, the number of employers interviewing graduating chemists and chemical engineers has changed little in the past two academic years; 43 interviewed chemists in both 1977–78 and 1978–79 (it was 33 in 1975–76), whereas the number that spoke with chemical engineers declined from 96 to 94 (it was 66 in 1975–76).

Although a few of Berkeley's graduating B.S. chemists had a hard time finding jobs, some received as many as six offers. Almost all of the graduating B.S. chemical engineers readily obtained employment.

Among the major recruiters of the university's graduating chemists and chemical engineers are petroleum and petrochemical companies, says Peggy Dempsey, technical placement adviser in the university's Career Planning & Placement Center. Electronics companies increasingly are seeking chemists and chemical engineers for R&D work on new materials and processes. In addition, companies developing new energy sources, she adds, are eagerly searching for qualified new chemical professionals.

Dempsey says, "I have seen no reflection of the nation's economic decline in terms of the number of job openings currently listed in our office and the number of employers who have scheduled recruiting visits. Frankly, I am quite optimistic about the job prospects for our technical graduates of all types in 1979–80."

The healthy demand for chemical professionals was shown last month by the lively activity at the ACS fall meeting in Washington, D.C., where 368 employer representatives used the Employment Clearing House, compared to 273 at the fall 1978 ACS national meeting in Miami Beach. By contrast, only 206 employers used ECH at the fall ACS meeting in Chicago in the recession year 1975.

Job applicants at the latest ACS national meeting totaled 589, compared to 339 in the fall of 1978. The number of positions listed at ECH for candidates' review in fall 1979 was 536, in contrast to 452 in fall 1978. The number of job interviews was 2279, compared to 1732 in fall 1978.

Even though the number of job interviews increased at the latest ACS national meeting, the number of job applicants rose even more. As a result, the average number of interviews per candidate declined to 3.9, compared to 5.1 in fall 1978. The average, however, was only 2.3 interviews per candidate in fall 1975.

Audra B. Rafter, manager of ACS Employment Aids Office, which operates ECH, reports that the largest number of job openings at the latest ECH was for polymer chemists. In previous years, the largest number had been for analytical chemists. At the fall 1979 meeting, the five types of job openings most often listed by employers were for polymer chemists (99 positions), analytical chemists (87), chemical engineers (62), organic

C&EN survey finds job prospects encouraging

C&EN's annual survey of major U.S. chemical employers indicates that employment prospects for chemists and chemical engineers are good. Between mid-1979 and mid-1980, these employers plan to expand their staffs of both chemists and chemical engineers. Although they expect to visit fewer colleges and universities to recruit chemists and chemical engineers in academic year 1979–80, they still intend to hire substantial numbers. The employment outlook for chemists, however, is not so good as that for chemical engineers.

Employers responding to the survey say they hired 14% more chemists in 1979 than in 1978. They expect to hire 6% fewer chemists next year than this year. The employers hired 39% more chemical engineers in 1979 than in 1978. Their hiring of chemical engineers in 1980 is expected to be 1% greater than in 1979.

Of the chemists hired, 58% were new graduates in both 1978 and 1979 and are expected to be 65% of the total in 1980. Of the chemical engineers hired, 72% were fresh out of school in 1978, 75% in 1979, and 81% are expected to be in 1980.

Employers report that the number of chemists on their staffs in mid-1979 was 2% greater than in mid-1978. The number also is expected to be 2% greater in mid-1980 than in mid-1979. For chemical engineers, the growth in staffs is expected to be 3% in both of these periods.

Respondents say that they made 5% more visits to colleges and universities to recruit chemists in academic year 1978–79 than in 1977–78. The number is expected to be 4% less in 1979–80 than in 1978–79. Visits to colleges and universities to recruit chemical engineers increased 8% in 1973–79 from 1977–78. The number is anticipated to be 3% less in 1979–80 than in 1978–79.

About 75% of employers say they are looking for chemists with specialized skills. This year, the specialists in greatest demand are, in descending order, analytical chemists, organic chemists, polymer chemists, and physical chemists. Last year, the top four were: polymer, analytical, organic, and physical chemists. Among many other types of chemists being sought by employers this year are specialists in inorganic chemistry, catalysis, biochemistry, geochemistry, pharmaceutical chemistry, and organometallic chemistry.

The employment picture for women chemists and chemical engineers is slowly improving. Employers report that women comprised 8% of their chemical personnel in both mid-1978 and mid-1979 and are expected to constitute 9% of their chemists in mid-1980. Respondents say that women constituted 3% of their chemical engineers in both mid-1978 and mid-1979 and are likely to comprise 4% of their chemical engineers in mid-1980.

The C&EN survey covers 42 employers of chemists and chemical engineers. These employers are mainly companies in the chemical industry, although they also include some firms in such allied industries as petroleum, rubber, pharmaceuticals, and food, as well as a few research institutes.

Not all respondents answered every question. The 34 organizations that reported the size of their chemical staffs indicated that, in mid-1979, they employed 14,252 chemists and 15,832 chemical engineers.

Employers generally believe that job prospects for chemists and chemical engineers in their organizations will be favorable during the next five years. Some 55% say the outlook for chemists is either very good or excellent, 36% say good, and 9% say fair. Fully 82% of the respondents say prospects for chemical engineers are either very good or excellent, 9% say good, and 9% say either fair or poor.

Number of B.S. degrees in chemistry and chemical engineering rose in 1977–78, but Ph.D.'s decreased

Academic year	Degrees awarded in chemistry[a]			Degrees awarded in chemical engineering		
	Bachelors	Masters	Ph.D.'s	Bachelors	Masters	Ph.D.'s
1967–68	10,847	2014	1757	3211	1156	367
1968–69	11,807	2070	1941	3557	1136	409
1969–70	11,617	2146	2208	3720	1045	438
1970–71	11,183	2284	2160	3815	1100	406
1971–72	10,721	2259	1971	3663	1154	394
1972–73	10,226	2230	1882	3636	1051	397
1973–74	10,525	2138	1828	3454	1045	400
1974–75	10,649	2006	1824	3142	990	346
1975–76	11,107	1796	1623	3203	1031	308
1976–77	11,322	1775	1571	3581	1086	291
1977–78	11,474	1892	1525	4615	1237	259

a Does not include biochemistry and geochemistry. Source: HEW's National Center for Education Statistics

chemists (57), and physical chemists (30). As usual, the demand for inorganic chemists was relatively low (13), although not so low as it has been at some ECH's (only two positions were offered in fall 1977).

According to the Office of Personnel Management (formerly the Civil Service Commission), the federal government's hiring of chemists has been declining in the past few years. It dropped from 601 in fiscal 1977 (an unusually good year) to 475 in fiscal 1978 and to an estimated 400 in fiscal 1979. In these same years, hiring of chemical engineers remained fairly constant at 58, 62, and 60, respectively.

These figures cover hiring of chemical professionals by about 80 federal agencies in the "competitive" civil service system, which does not include such "excepted" agencies as the Federal Bureau of Investigation, the Central Intelligence Agency, and the Tennessee Valley Authority. Moreover, these data do not include high-level personnel in the "supergrades" above grade 15.

According to William E. Robinson, a program manager at the Office of Personnel Management, 8256 chemists were on the staffs of the competitive federal agencies in October 1978. The number of chemical engineers was 1465.

The College Placement Council, Bethlehem, Pa., says that college recruiting at the bachelor's level in 1978–79 was probably the most active in the 19-year history of CPC's annual surveys. These surveys provide information on job offers made to graduating students in a wide range of fields at a representative group of colleges and universities (now 161) throughout the U.S.

Bachelor's-degree candidates received 17% more offers in 1978–79 than in 1977–78. On the other hand, master's-degree candidates received 16% fewer offers, and Ph.D. candidates got 7% fewer offers.

The council also indicates that employers made 24% more offers in 1978–79 than in 1977–78 to engineering graduates at the bachelor's-degree level. Engineering graduates, in fact, received 61% of all bachelor's offers in 1978–79. The number of offers made to chemical engineering graduates, which accounted for 10% of the total B.S. volume, was up 19% in 1978–79 compared to 1977–78.

The number of offers made to graduating B.S. scientists increased 9% in the past academic year. The biggest growth occurred in the computer science field; job offers to B.S. computer scientists rose 26% over those in 1977–78 and 71% over those in 1976–77.

CPC also reports that women with bachelor's degrees received 21% of all job offers in 1978–79. This is the same percentage as in 1977–78 but was a considerable gain over the 13% of 1974–75.

The number of chemists and chemical engineers whom employers can hire is affected significantly by how degrees are awarded in these fields. Between academic years 1976–77 and 1977–78, the number of people who received bachelor's degrees in chemistry (excluding biochemistry and geochemistry) grew from 11,322 to 11,474, according to the National Center for Education Statistics. In the same period, Ph.D. degrees awarded in chemistry slipped from 1571 to 1525. In fact, Ph.D. graduates in chemistry have been declining every year since 1969–70's high of 2208.

Bachelor's degrees in chemical engineering rose sharply from 3581 in 1976–77 to 4615 in 1977–78, the most ever. Back in 1967–68, for example, only 3211 chemical engineering graduates received bachelor's degrees. The trend for Ph.D.'s in chemical engineering is just the reverse, falling from 291 in 1976–77 to 259 in 1977–78. Actually, the number of chemical engineering Ph.D. degrees has been decreasing every year since 400 students were awarded the degree in 1973–74.

Unemployment among chemists continues to decline. According to a survey of close to 11,000 ACS members, 1.1% were unemployed but seeking employment as of March 1, 1979. This compares with 1.4% on March 1, 1978, and 1.5% on March 1, 1977. By contrast, the unemployment rate among the total civilian labor force was 5.7% in March 1979, 6.2% in March 1978, and 7.4% in March 1977.

Among male members, 1.0% were unemployed but seeking employment on March 1, 1979, compared to 1.2% on March 1, 1978, and 1.3% a year earlier. Among female members, the comparable figures were 2.3%, 2.8%, and 3.4%, respectively. As these figures show, the job picture for female members is improving.

A chemist who is unemployed but seeking employment may remain jobless for some time. Among the survey respondents who were unemployed at any time during the year ending March 1, 1979, 26% were without work for up to three months, 44% for three to 12 months, 22% for 12 to 36 months, and 8% for 36 months or more.

According to the American Institute of Chemical Engineers, only 0.4% of its members were unemployed in February 1979, the same as a year earlier. By comparison, 3.7% of its members were without jobs in mid-1971. The median length of time that an AIChE member remained unemployed during the survey period was three months. The median length of time reported in the 1978 survey was only two months and in the 1977 survey six months.

The volume of "positions open" advertising in C&EN, a useful indicator of how actively employers are seeking chemists and chemical engineers, has been exceptionally large this year. Between January and early October 1979, the volume of such advertising in four consecutive issues of C&EN exceeded 900 column-inches 10 times. On the other hand, between January and early October 1978, it exceeded 900 column-inches only twice.

The four consecutive issues of C&EN ending with Oct. 1, 1979, carried 1284 column-inches of "positions open" advertising. Such C&EN advertising this year is, in fact, the largest since 1967. □

1980 SALARIES

Salaries of most chemists rise but lose ground to inflation

Between March 1978 and March 1979, the median salaries of experienced chemists rose 7% for B.S.'s, 4% for M.S.'s, and 6% for Ph.D.'s. On the other hand, initial salaries of B.S. chemists fresh out of school this year were 14% higher than starting B.S.'s received a year ago, 13% higher for new M.S.'s, and 10% higher for this year's crop of Ph.D.'s.

During this period, the consumer price index, unfortunately, climbed 10%. Thus, salary increases did not keep pace with inflation for experienced chemists, no matter what their degree. Newly graduated chemists, however, fared somewhat better in salaries.

These are among the results of two annual salary surveys carried out by ACS's Office of Manpower Studies. One survey, which covers only ACS members, was issued in midyear as the 1979 Report of Chemists' Salaries and Employment Status (C&EN, June 25, page 39). The other deals with inexperienced chemistry and chemical engineering graduates (those with 12 months or less of professional experience), many of whom are not ACS members. Its findings will be published in early November as the 1979 Survey Report of Starting Salaries and Employment Status of Chemistry and Chemical Engineering Graduates.

The 1979 salary survey of experienced chemists and chemical engineers was based on responses from close to 11,000 ACS members who reported their annual salaries as of March 1, 1979. The survey indicates that the median annual salary of B.S. chemists, at all professional experience levels, rose 7% from $22,000 in 1978 to $23,500 in 1979. For M.S. chemists, the median increased 4% from $24,000 in 1978 to $25,000 in 1979. Among Ph.D.'s, the median rose 6% from $27,400 in 1978 to $29,000 in 1979.

The survey also indicates that the median annual salary of ACS-member B.S. chemical engineers climbed 6% from $30,000 in 1978 to $31,700 in 1979. The median for M.S. chemical engineers declined 2% from $32,000 in 1978 to $31,500 in 1979. For Ph.D. chemical engineers, the median rose 9% from $32,000 in 1978 to $35,000 in 1979. Harry J. Foxwell, statistician in the ACS Office of Manpower Studies, believes that the apparent 2% decline in the median salary of M.S. chemical engineers may well have resulted from sampling errors because this group consists of relatively few people.

The median annual salary of members of the American Institute of Chemical Engineers (at all degree levels) increased 7% from $27,500 in 1978 to $29,500. Typically, the median salaries reported by AIChE members are smaller than those reported by ACS mainly because the former are younger than the chemical engineers who are also ACS members, these latter being generally older and more experienced.

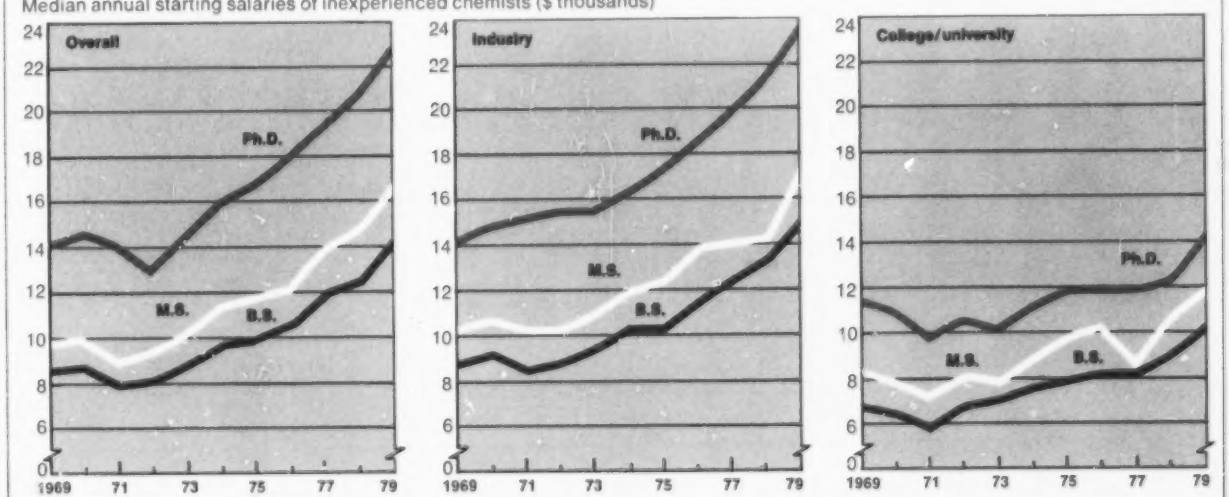
The median salary of all member chemists, whatever their degree, rose about 6% between March 1978 and March 1979. On the other hand, because of the 10% increase in the consumer price index during the same 12-month period, in constant dollars the median annual salary of chemists actually declined about 4%. This year's decrease in constant-dollar salaries is, in fact, the greatest since 1975.

Where chemists work affects their salaries. Among Ph.D. chemists, for example, the median salary in 1979 was $33,000 for those in manufacturing industry, $32,000 in the federal government, $27,600 in nonprofit organizations, $24,500 in public colleges and universities, and $23,000 in private colleges and universities.

Women chemists receive lower salaries than men who hold the same degrees and are doing the same types of jobs. One reason is the salary discrimination to which women long have been subjected in almost all professions, although this is now

Starting salaries this year rise at all degree levels

Median annual starting salaries of inexperienced chemists ($ thousands)



Source: ACS starting salary surveys

gradually being reduced. Another reason is that female chemists tend to be younger than male chemists and, therefore, less experienced. Female members of ACS who responded to its 1979 survey had a median age of 36, whereas male members had a median age of 44. In addition, women are less likely than men to work in higher-paying positions, such as management, but are more likely to work for universities and colleges, where salaries tend to be lower. Women also are less likely to have a Ph.D. degree. However, median salaries for women with B.S. degrees and less than four years of experience are higher than those of their male counterparts.

In 1979, the median salary of B.S. chemists was $25,000 for men and $17,500 for women. For M.S. chemists, the median salary was $26,000 for men and $19,500 for women. For Ph.D. chemists, it was $30,000 for men and $22,000 for women.

In industry in 1979, the median salary of B.S. chemists was $25,000 for men and $17,500 for women. The median for M.S. chemists in industry was $27,500 for men and $20,200 for women. For Ph.D. chemists, it was $33,000 for men and $26,400 for women.

The results of the 1979 ACS starting salary survey, which are based on replies from close to 4500 new chemistry and chemical engineering graduates, are reported here for the first time. They show that the median annual starting salary of inexperienced B.S. chemists working full time was $14,500, 14% above the $12,700 reported in 1978. The median starting salary of M.S. chemists climbed to $17,000, up 13% from $15,000 in 1978. In the same period, the median starting salary of Ph.D. chemists rose 10% from $21,000 to $23,000. These increases are decidedly greater than the 6 to 8% gains reported for the period between 1977 and 1978.

Characteristically, the median starting salaries of inexperienced chemical engineers are higher than those of chemists. The median starting salary of B.S. chemical engineers working full time, at $19,800 in 1979, was 9% higher than the $18,200 in 1978. In the same period, the median for M.S. chemical engineers rose 9% from $19,200 to $21,000. The median for Ph.D. chemical engineers increased 10% from $23,100 to $25,400.

The median starting salaries of full-time chemists and chemical engineers are influenced by their type of employer. In 1979, the medians for inexperienced full-time B.S. chemists were $15,000 for those in industry; $11,800 for those in federal, state, and local governments; $11,700 for those in hospitals, independent laboratories, and nonprofit organizations; and $10,300 for those in colleges and universities. The medians for inexperienced, full-time B.S. chemical engineers were $19,800 for those in industry; $18,000 for those in federal, state, and local governments; and $19,500 for those in hospitals, independent laboratories, and nonprofit organizations.

For the past several years, the median starting salaries of B.S. women chemists and chemical engineers in industry have been greater than those of their male counterparts. In 1979, the median for industrial B.S. chemists was $15,600 for women and $15,000 for men. The median for industrial B.S. chemical engineers was $20,000 for women and $19,800 for men. The higher initial salaries paid to women clearly reflect vigorous competition as companies, as part of their affirmative action programs, try to increase the number of women chemical professionals on their staffs.

Among inexperienced 1979 B.S. chemists, 28% are employed full time in the chemical profession. In addition, 30% are not seeking full-time employment (mainly because they are undertaking further studies), 24% hold graduate assistantships or fellowships, 9% are working outside the chemical profession, and 9% are unable to obtain full-time employment.

Among inexperienced 1979 Ph.D. chemists, 56% are employed full time in the chemical profession, 38% have postdoctoral fellowships, 4% are working outside the chemical profession, and 2% are unable to obtain full-time employment.

In recent years, the job outlook for new Ph.D. chemists has improved noticeably. This is reflected in the proportion of new Ph.D. chemists who are working full time in the chemical profession, which has risen from 44% in 1976 to 56% in 1979. Moreover, the proportion of new Ph.D.'s who undertake postdoctoral study, which some do because they cannot obtain other jobs, has declined from a high of 49% in 1976 to 38% this year.

Most new 1979 chemical engineers have full-time jobs in the chemical profession—72% of B.S. chemical engineers, 68% of M.S.'s, and 89% of Ph.D.'s. Those with full-time jobs outside the chemical profession constitute only 8% of B.S. and M.S. chemical engineers, 2% of Ph.D.'s. □

Salaries vary considerably with profession

Chemists' salaries have been rising. But how do they stack up against the earnings of other groups of professional workers?

Good, solid data gathered on an equivalent basis so that valid comparisons can be made are not generally available. Nevertheless, figures have been collected by various groups that at least give a clue to the level of earnings in various professions.

The American Medical Association reports, for example, that physicians had an average net income from their medical practice of about $63,000 in 1978. The American Dental Association finds that dentists' average net income from professional practice was about $50,000 during the same year. And according to the American Institute of Physics, the average salary of members (most of whom are physicists) of the societies of which it is composed, was about $27,500 last March.

The Bureau of Labor Statistics also gathers information on the average salaries for various white-collar occupations in private industry, largely to help set pay levels for federal employees. The resulting data (see accompanying table) permit some loose comparisons to be made between various professional and administrative occupations, at various levels of experience and job responsibility. BLS states, for example, that the figures it reports for mid-level chemists and engineers cover "fully experienced" employees, those for the top level cover only those employees responsible for "highly complex programs."

In general, the highest salaries for any profession surveyed by BLS are those earned by attorneys. (The figures cover only members of the bar working in the legal departments of industrial firms.) Engineers (of all types) and chemists are close behind.

	Average annual salary[a]
Attorneys, top level	$56,964
Chemists, top level	48,961
Chief accountants, top level	45,274
Engineers, top level	45,221
Personnel directors, top level	43,933
Accountants, top level	29,744
Engineers, mid-level	25,989
Chemists, mid-level	25,459
Personnel directors, starting	22,996
Attorneys, starting	18,740
Engineers, starting	17,345
Chemists, starting	14,455
Accountants, starting	13,790

a As of March 1979, excluding overtime and nonproduction bonuses. **Source:** Bureau of Labor Statistics

CAREER 1980 PLANNING

Career Planning is designed to familiarize both the student and the experienced graduate with services, sources of information, and organizations that can supply guidance in selecting, obtaining, and changing careers. The directory is a guide to U.S. organizations that employ significant numbers of chemists and chemical engineers. It is, of course, not all-inclusive. The directories listed under General Information, for instance, include the names of other organizations that employ chemists and chemical engineers. Inquiries about career opportunities in specific organizations should be addressed directly to the organization, in care of the personnel director.

GENERAL INFORMATION

American Chemical Society: *Chemical & Engineering News* salary surveys, employment surveys, and classified ads (see also ACS Information below), 1155—16th St., N.W., Washington, D.C. 20036.

Directories: "American Council of Independent Laboratories Directory, 1978," 1725 K St., N.W., Washington, D.C. 20006 (next edition will be published in 1980); "Association of Consulting Chemists & Chemical Engineers Council Directory," 20th edition, 1979, 50 East 41st St., New York, N.Y. 10017; "College Placement Annual, 1980," College Placement Council, P.O. Box 2263, Bethlehem, Pa. 18001; "American Consulting Engineers Council Membership Directory, 1979–80," 1155—15th St., N.W., Washington, D.C. 20005; "1979 Directory of Chemical Producers," SRI International, Menlo Park, Calif. 94025; "Industrial Research Laboratories of the United States," 16th edition, 1979, R. R. Bowker Co., 1180 Ave. of the Americas, New York, N.Y. 10036; "Research Centers Directory," 6th edition, 1979, Gale Research Co., Book Tower, Detroit, Mich. 48226.

Chemical Manufacturers Association: The brochures "Your Tomorrow—A Guide to Careers in the Chemical Industry" and "Minority Engineers in the Chemical Industry—A Guide to Career Selection" are available free from CMA's Publications Service, 1825 Connecticut Ave., N.W., Washington, D.C. 20009.

Scientific Manpower Commission: "Science and Engineering Careers—A Bibliography," April 1974, $2.00; "Salaries of Scientists, Engineers, and Technicians," 8th edition, October 1977, $15; "Salaries of Scientists, Engineers, and Technicians," 9th edition, October 1979, $20; "Professional Women and Minorities—A Manpower Data Resource Service," 1978, $75 (1979 supplement, $30); "Supply and Demand for Scientists and Engineers—A Review of Selected Studies," February 1977, $3.00; "Manpower Planning for Scientists and Engineers," May 1977, $2.00; *Manpower Comments*, 10 issues a year, $25 per year. All available from 1776 Massachusetts Ave., N.W., Washington, D.C. 20036.

Scientific and professional societies: American Institute of Chemists, 7315 Wisconsin Ave., Washington, D.C. 20014; American Institute of Chemical Engineers, 345 East 47th St., New York, N.Y. 10017; and National Society of Professional Engineers, 2029 K St., N.W., Washington, D.C. 20006. They offer information on their specific programs for career guidance and assistance.

Sources of information about prospective employers: Available in public libraries, "Moody's Industrial Manual," "Dun & Bradstreet," "Thomas Register of American Manufacturers," and "Standard and Poor's Register."

U.S. Department of Labor: Occupational Outlook Handbook, 1978–79 edition, Bulletin 1955, $8.00 per paperback copy. Order from Bureau of Labor Statistics, 1515 Broadway, New York, N.Y. 10036, or other regional office of BLS.

Vocational guidance manuals: "Opportunities in Chemistry" by John H. Woodburn, 1978; "Opportunities in Environmental Careers" by Odom Fanning, 1975; "Opportunities in Materials Science and Engineering" by Charles Wert, 1979; "Energy Careers" by John H. Woodburn, 1978; and "Chemical Engineering" by Joseph Haggerty, Earl Gerhard, and Charles Plank, 1978. Available from VGM Career Horizons, a division of National Textbook Co., 8259 Niles Center Rd., Skokie, Ill. 60077. "Encyclopedia of Careers and Vocational Guidance" by William E. Hopke, editor, 1978. Volume 1: "Planning Your Career." Volume 2: "Careers and Occupations." "Woman's Guide to Career Preparation" by Ann Jawin, 1979. Available from Doubleday & Co., 501 Franklin Ave, Garden City, N.Y. 11530.

ACS INFORMATION

Education aids for high school students: "Careers in Chemistry: Questions and Answers," "Chemical Technology Programs," "List of ACS Approved Schools," and "Financial Aids for College Students." All single copies free from ACS Special Issues Sales. *SciQuest*, published 10 times a year, $9.00 per year or $23 for three years. Group rates of 10 or more subscriptions entered with a single payment but mailed to different addresses, $6.50 each. Bulk subscriptions that are entered with a single payment for the school term and are mailed to one address, as low as $3.75 each, depending on the number of subscriptions ordered. Available from ACS Circulation Development Department, 1155—16th St., N.W., Washington, D.C. 20036.

Education aids for college students: "College Chemistry Seniors," a listing of résumés submitted by seniors majoring in chemistry and chemical engineering who plan to enter graduate school, 1979–80 edition, $30; "Directory of Graduate Research," a listing of Ph.D. degree-granting departments of chemistry, chemical engineering, biochemistry, and pharmaceutical/medicinal chemistry in the U.S. and Canada, with names of faculties, their research interests, and bibliographies of their recent publications, 1979 edition, $30;

and "College Chemistry Faculties," a listing of two- and four-year college and university teachers of chemistry, chemical engineering, and biochemistry in the U.S., Canada, and Mexico, fourth edition (1977), $15. All available from ACS Special Issues Sales. "Graduate School Information Aids," "Careers Nontraditional," and "Chemical Careers in the 1980's" are also available from ACS Special Issues Sales, single copy free. *Journal of Chemical Education*, a monthly publication of the ACS Division of Chemical Education, $12 per year for regular domestic subscribers and $9.00 per year for students. Available from *Journal of Chemical Education*, Subscription Fulfillment Department, 20th and Northampton St., Easton, Pa. 18042.

Continuing education aids: ACS Short Courses, live, intensive state-of-the-art courses in chemistry offered publicly year round, also available to organizations on an in-house basis; ACS Audio Courses, taped state-of-the-art courses by recognized authorities; ACS Film/Video Courses, chemistry lectures on 16-mm film and videotape; and ACS Interaction Courses, correspondence courses developed by experts and given by well-qualified instructors. All available from ACS Department of Educational Activities.

Employment information: "Professionals in Chemistry 1978," $11 to ACS members, $22 to nonmembers; "1979 Report of Chemists' Salaries and Employment Status," $10 to ACS members, $25 to nonmembers; "1978 Survey Report, Starting Salaries and Employment Status of Chemistry and Chemical Engineering Graduates," $2.00 to ACS members, $5.00 to nonmembers. All from ACS Special Issues Sales. The 1978 edition of "Professional Employment Guidelines" is free; send stamped, self-addressed, business-size envelope; "Chemistry: A Job or a Career?" consists of a 30-minute cassette tape, booklets, and a 30-mm slide presentation that are offered free to student affiliate chapters and to chemistry and chemical engineering departments. Available from ACS Department of Professional Relations & Manpower Studies.

Salary information in C&EN: Starting salaries in 1978, C&EN, Oct. 23, 1978, page 29. Comprehensive salary survey in 1979, C&EN, June 25, page 39.

ACS EMPLOYMENT AIDS

Employment Clearing House: ACS members and student affiliates in search of a new position can file applications in the Washington office at no charge. Employers may write or call the Washington office to receive copies of résumés of applicants who possess qualifications specified for the positions. The service is year-round and nonconfidential.

Confidential Employment Listing: This service enables employed ACS members who are seeking a new position to have their résumés on file at the ACS Employment Aids Office and to have them made available to all but certain specified employers, such as their present employer. This listing enables experienced candidates who otherwise would not wish to have their résumés circulated on a nonrestricted basis to let all but specified employers know of their desire to find a new position. Because of the added cost of handling such confidential records, ACS members are charged $25 a year for such a listing.

Employment Clearing House, National Meetings: The society aids ACS members and employers to arrange on-the-spot interviews at ACS national meetings. This free, nonconfidential service is open to those registered and in attendance at the meeting. Unemployed members may have registration fees waived on request.

Academic Openings: This publication lists positions, including postdoctoral positions, available at colleges and universities. It is published on a monthly basis if sufficient notices are received from academic institutions. The 20th of any month is the deadline for publication. If too few listings are received, publication is held over until the next month. This service is provided for all those interested in academic employment. Starting in January 1980, subscriptions to Academic Openings will cost $12 a year and can be obtained by writing to the ACS Employment Aids Office.

C&EN employment advertising section: Student affiliates and employed ACS members receive discounts from regular advertising rates. ACS members who are unemployed or are under notice of involuntary unemployment within 60 days may place one free classified "situations wanted" advertisement that will appear in every other issue for a period of six months—for a total of 13 insertions a year. Student members or student affiliates who have not gained employment two months before graduation are entitled to the same privileges. Retired members are entitled to six free nondisplay advertisements a year. See the Employment Ads Information box at the start of the C&EN employment advertising section for instructions.

Résumé service: An unemployed member may obtain free up to 50 printed copies of his or her résumé, limited to two pages typed in reproducible form. Write ACS Employment Aids Office.

ACS local sections: Some sections provide employment assistance. Contact the secretary of the local section.

For ACS information listed in this section, write to American Chemical Society, 1155—16th St., N.W., Washington, D.C. 20036.

OTHER EMPLOYMENT SERVICES

Classified listings: *Chemical & Engineering News*, weekly newsmagazine of the American Chemical Society; *Chemical Engineering Progress*, monthly magazine of the American Institute of Chemical Engineers; *The Chemist*, monthly publication of the American Institute of Chemists; *Science*, weekly magazine of the American Association for the Advancement of Science; and classified sections of newspapers.

College placement bureaus: Campus placement offices usually maintain a file of openings for graduating students and recent graduates. They frequently arrange interviews between students and employers.

Private placement agencies: Check those in your area to determine what services are offered. They differ widely in quality, cost, and nature of service.

State employment agencies: These organizations list openings for professional people without charge and also provide guidance on available government programs for retraining scientists and engineers.

U.S. Civil Service Commission: This agency maintains a listing of open examinations for jobs in government laboratories and other installations. Descriptions, locations, and salary information are available by writing to the commission at 1900 E St., N.W., Washington, D.C. 20415.

ORGANIZATIONS FOR WOMEN

American Association for the Advancement of Science: Office of Opportunities in Science, 1776 Massachusetts Ave., N.W., Washington, D.C. 20036; Women's Caucus, Phyllis Kahn, Member, Minnesota State Legislature, State Capitol, St. Paul, Minn. 55155.

American Association of University Professors: Committee on Status of Women in the Profession, AAUP, 1 Dupont Circle, N.W., Washington, D.C. 20036.

American Chemical Society: Women Chemists Committee, Wanda L. Brown, 21% Brightwood Pl., San Antonio, Tex. 78209
American Society of Biological Chemists: Committee on Equal Opportunities for Women, Elizabeth S. Maxwell, ASBC, 9650 Rockville Pike, Bethesda, Md. 20014.
Association for Women in Science: Room 1122, 1346 Connecticut Ave., N.W., Washington, D.C. 20036.
Sigma Delta Epsilon—Graduate Women in Science: Eltora Schroeder, SDE-GWS, Room 1102, 1346 Connecticut Ave., N.W., Washington, D.C. 20036.
Society of Women Engineers: Mary Lou Barnas, Executive Secretary, Room 305, 345 East 47th St., New York, N.Y. 10017.

Directory

The following list includes most of the nation's major employers of chemists and/or chemical engineers. The organizations did not ask to be included in this directory and are not necessarily hiring chemists or chemical engineers at this time.

Chemicals

Aceto Chemical Co., 126-02 Northern Blvd., Flushing, N.Y. 11368
Airco, 85 Chestnut Ridge Rd., Montvale, N.J. 07645 (subsidiary of BOC International Ltd. of the U.K.)
Air Products & Chemicals, P.O. Box 538, Allentown, Pa. 18105
Akzona, P.O. Box 2930, Asheville, N.C. 28802 (affiliated with Akzo N.V. of the Netherlands)
Alcolac, 3440 Fairfield Rd., Baltimore, Md. 21226
Aldrich Chemical Co., 940 West St. Paul Ave., Milwaukee, Wis. 53233
Allied Chemical Corp., P.O. Box 2245R, Morristown, N.J. 07960
American Color & Chemical Corp., P.O. Box 1688, Charlotte, N.C. 28232 (subsidiary of North American Philips Corp.)
American Cyanamid Co., 859 Berdan Ave., Wayne, N.J. 07470
American Enka Co., Enka, N.C. 28728 (division of Akzona)
American Hoechst Corp., Rte. 202-206 North, Somerville, N.J. 08876 (owned by Hoechst A.G. of West Germany)
American Hoechst Corp., industrial chemicals division, P.O. Box 268, Coventry, R.I. 02816
Amoco Chemicals Corp., 200 East Randolph Dr., Chicago, Ill. 60601 (subsidiary of Standard Oil Co. (Ind.))
Ansul Co., 101 Stanton St., Marinette, Wis. 54143
Apex Chemical Co., 200 South First St., Elizabethport, N.J. 07206
Arco Chemical Co., 1500 Market St., Philadelphia, Pa. 19101 (division of Atlantic Richfield Co.)
Arizona Chemical Co., 859 Berdan Ave., Wayne, N.J. 07470 (affiliate of American Cyanamid Co. and International Paper Co.)
Armak Co., P.O. Box 1805, Chicago, Ill. 60690 (subsidiary of Akzona)
Ashland Chemical Co., P.O. Box 2219, Columbus, Ohio 43216 (division of Ashland Oil)
AZS Corp., P.O. Box 93366, Atlanta, Ga. 30318
Badische Corp., Williamsburg, Va. 23185 (member of BASF Group of West Germany)
J. T. Baker Chemical Co., 223 Red School Lane, Phillipsburg, N.J. 08865 (subsidiary of Richardson-Merrell)
BASF Wyandotte Corp., 100 Cherry Hill Rd., Parsippany, N.J. 07054 (owned by BASF A.G. of West Germany)
Beaunit Corp., 261 Madison Ave., New York, N.Y. 10016 (subsidiary of El Paso Natural Gas Co.)
Betz Laboratories, 4636 Somerton Rd., Trevose, Pa. 19047
Big Three Industries, P.O. Box 3047, Houston, Tex. 77001
Borden Chemical, 180 East Broad St., Columbus, Ohio 43215 (division of Borden)
Borg-Warner Corp., 200 South Michigan Ave., Chicago, Ill. 60604
Buckeye Cellulose Corp., P.O. Box 8407, Memphis, Tenn. 38108 (subsidiary of Procter & Gamble Co.)
Buckman Laboratories, 1256 North McLean Blvd., Memphis, Tenn. 38108
Cabot Corp., 125 High St., Boston, Mass. 02110
Calbiochem-Behring Corp., 10933 North Torrey Pines Rd., La Jolla, Calif. 92037 (subsidiary of American Hoechst Corp.)
Calgon Corp., P.O. Box 1346, Pittsburgh, Pa. 15230 (subsidiary of Merck & Co.)
Callery Chemical Co., Callery, Pa. 16024 (division of Mine Safety Appliances Co.)
Carus Corp., 1500 Eighth St., La Salle, Ill. 61301
Celanese Corp., 1211 Ave. of the Americas, New York, N.Y. 10036
CF Industries, Salem Lake Dr., Long Grove, Ill. 60047
Chemagro Agricultural division, P.O. Box 4913, Kansas City, Mo. 64120 (division of Mobay Chemical Corp.)
Chemed Corp., 1200 DuBois Tower, Cincinnati, Ohio 45202 (owned 90% by W. R. Grace & Co.)
Chemetron Corp., 111 East Wacker Dr., Chicago, Ill. 60601 (part of Allegheny Ludlum Industries)
Chemplex Co., 3100 Gold Rd., Rolling Meadows, Ill. 60008 (affiliate of American Can Co. and Getty Oil Co.)
Chevron Chemical Co., 575 Market St., San Francisco, Calif. 94105 (subsidiary of Standard Oil Co. of California)
Ciba-Geigy Corp., 444 Saw Mill River Rd., Ardsley, N.Y. 10502 (owned by Ciba-Geigy Ltd. of Switzerland)
Cincinnati Milacron, 4701 Marburg Ave., Cincinnati, Ohio 45209
City Chemical Corp., 134 West 22nd St., New York, N.Y. 10011
Clorox Co., 1221 Broadway, Oakland, Calif. 94612
Collier Carbon & Chemical Corp., P.O. Box 60455, Los Angeles, Calif. 90060 (subsidiary of Union Oil Co. of California)
Columbia Nitrogen Corp., P.O. Box 1483, Augusta, Ga. 30903 (owned by DSM of the Netherlands)
Conoco Chemicals, P.O. Box 2197, Houston, Tex. 77001 (division of Continental Oil Co.)
Cooperative Farm Chemical Association, P.O. Box 308, Lawrence, Kan. 66044
Copolymer Rubber & Chemical Corp., P.O. Box 2591, Baton Rouge, La. 70821
Crompton & Knowles Corp., dyes & chemicals division, Rte. 208, Fair Lawn, N.J. 07410
Cyclo Chemicals Corp., 7500 North West 66th St., Miami, Fla. 33166
Dart Industries, P.O. Box 3157, Terminal Annex, Los Angeles, Calif. 90051
Daubert Chemical Co., 1200 Jorie Blvd., Oak Brook, Ill. 60521
Dearborn Chemical, 300 Genesee St., Lake Zurich, Ill. 60047 (division of Chemed Corp.)
Detrex Chemical Industries, P.O. Box 501, Detroit, Mich. 48232
Dexter Chemical Corp., 845 Edgewater Rd., Bronx, N.Y. 10474
Dexter Corp., 1 Elm St., Windsor Locks, Conn. 06096
Diamond Shamrock Corp., 1100 Superior Ave., Cleveland, Ohio 44114
Diversey Corp., 100 West Monroe St., Chicago, Ill. 60603
Dixie Chemical Co., P.O. Box 13410, Houston, Tex. 77019
Dow Chemical U.S.A., 2020 Dow Ctr., Midland, Mich. 48640
Dow Corning Corp., P.O. Box 592, Midland, Mich. 48640 (jointly owned by Dow Chemical Co. and Corning Glass Works)
Drew Chemical Corp., 1 Drew Chemical Plaza, Boonton, N.J. 07005 (subsidiary of U.S. Filter Corp.)
DuBois Chemicals, 1314 DuBois Tower, Cincinnati, Ohio 45202 (division of Chemed Corp.)
E. I. du Pont de Nemours & Co., 1007 Market St., Wilmington, Del. 19898
Eagle-Picher Industries, 580 Walnut St., Cincinnati, Ohio 45202
Eastern Chemical divisies, P.O. Box 2500, Hauppauge, N.Y. 11787 (division of Guardian Chemical Corp.)
Eastman Chemical Products, P.O. Box 431, Kingsport, Tenn. 37662 (subsidiary of Eastman Kodak Co.)
Economics Laboratory, 370 Wabasha St., St. Paul, Minn. 55102
Emery Industries, 1300 Carew Tower, Cincinnati, Ohio 45202 (subsidiary of National Distillers & Chemical Corp.)
Emkay Chemical Co., 319-325 Second St., Elizabeth, N.J. 07206
Enserch Corp., 301 South Harwood St., Dallas, Tex. 75201
Essex Chemical Corp., 1401 Broad St., Clifton, N.J. 07015
Ethyl Corp., 330 South Fourth St., Richmond, Va. 23219
Exxon Chemical Co., 1251 Ave. of the Americas, New York, N.Y. 10020 (division of Exxon Corp.)
Fairmount Chemical Co., 117 Blanchard St., Newark, N.J. 07105
Farchan division, 4702 East 355th St., Willoughby, Ohio 44094 (division of Story Chemical Corp.)
Farmland Industries, P.O. Box 7305, Kansas City, Mo. 64116
Ferro Corp., 1 Erieview Plaza, Cleveland, Ohio 44114
Fiber Industries, Hwy. 70 West, Salisbury, N.C. 28144 (jointly owned by Celanese Corp. and Imperial Chemical Industries of the U.K.)
Filtrol Corp., 5959 West Century Blvd., Los Angeles, Calif. 90045 (subsidiary of U.S. Filter Corp.)
Firestone Plastics Co., P.O. Box 699, Pottstown, Pa., 19464 (division of Firestone Tire & Rubber Co.)
First Chemical Corp., P.O. Box 1427, Pascagoula, Miss. 39567 (subsidiary of First Mississippi Corp.)
Fisher Scientific Co., chemical manufacturing division, 711 Forbes Ave., Pittsburgh, Pa. 15219
FMC Corp., 200 East Randolph Dr., Chicago, Ill. 60601
FMC Corp., industrial chemical group, 2000 Market St., Philadelphia, Pa. 19103
Foster Grant Co., 289 North Main St., Leominster, Mass. 01453 (subsidiary of American Hoechst Corp.)
Fritzsche Dodge & Olcott, 76 Ninth Ave., New York, N.Y. 10011
GAF Corp., 140 West 51st St., New York, N.Y. 10020
General Electric Co., engineered materials group, 500 West Wilson Bridge Rd., Columbus, Ohio 43085
General Electric Co., plastics business division, 1 Plastics Ave., Pittsfield, Mass. 01201
General Latex & Chemical Corp., 666 Main St., Cambridge, Mass. 02139
General Tire & Rubber Co., chemical/plastics division, 1 General St., Akron, Ohio 44329
Georgia-Pacific Corp., 900 South West Fifth Ave., Portland, Ore. 97204
Givaudan Corp., 100 Delawanna Ave., Clifton, N.J. 07014
Glyco Chemicals, P.O. Box 700, Greenwich, Conn. 06830
B. F. Goodrich Chemical Co., 6100 Oak Tree Blvd., Cleveland, Ohio 44131 (division of B. F. Goodrich Co.)
Goodyear Tire & Rubber Co., chemical division, 1144 East Market St., Akron, Ohio 44316
W. R. Grace & Co., 1114 Ave. of the Americas, New York, N.Y. 10036
Great Lakes Carbon Corp., 299 Park Ave., New York, N.Y. 10017
Great Lakes Chemical Corp., P.O. Box 2200, West Lafayette, Ind. 47906
Great Salt Lake Minerals & Chemicals Corp., P.O. Box 1190, Ogden, Utah 84402 (subsidiary of Gulf Resources & Chemical Corp.)
Grow Chemical Corp., 345 Park Ave., New York, N.Y. 10022
GTE Sylvania, 1 Stamford Forum, Stamford, Conn. 06904 (subsidiary of General Telephone & Electronics Corp.)
Guardian Chemical Corp., 230 Marcus Blvd., Hauppauge, N.Y. 11787
Gulf Oil Chemicals Co., P.O. Box 3766, Houston, Tex. 77001 (division of Gulf Oil Corp.)
Hach Chemical Co., P.O. Box 389, Loveland, Colo. 80537
C. P. Hall Co., 7300 South Central Ave., Chicago, Ill. 60638
Harshaw Chemical Co., 1933 East 97th St., Cleveland, Ohio 44106 (subsidiary of Kewanee Industries)
Henkel Corp., 4620 West 77th St., Minneapolis, Minn. 55435 (subsidiary of Henkel of West Germany)
Hercules, 910 Market St., Wilmington, Del. 19899
Hilton-Davis Chemical Co., 2235 Langdon Farm Rd., Cincinnati, Ohio 45237 (division of Sterling Drug)
Hitco, 1600 West 135th St., Gardena, Calif. 90249 (subsidiary of Armco)
Hoechst Fibers Industries, 1515 Broadway, New York, N.Y. 10036 (division of American Hoechst Corp.)

Hooker Chemicals & Plastics Corp., 1034 Iroquois Ave., Niagara Falls, N.Y. 14302 (subsidiary of Occidental Petroleum Corp.)
Humko Sheffield Chemical, P.O. Box 398, Memphis, Tenn. 38101 (division of Kraft)
Humphrey Chemical Co., Devine St., North Haven, Conn. 06473
Philip A. Hunt Chemical Corp., P.O. Box 800, Palisades Park, N.J. 07650
ICI United States, Concord Pike & New Murphy Rd., Wilmington, Del. 19897 (owned by a subsidiary of Imperial Chemical Industries Ltd. of U.K.)
IMC Chemical Group, 666 Garland Pl., Des Plaines, Ill. 60016 (subsidiary of International Minerals & Chemical Corp.)
Inmont Corp., 1133 Ave. of the Americas, New York, N.Y. 10036
International Flavors & Fragrances, 521 West 57th St., New York, N.Y. 10019
International Minerals & Chemical Corp., Hwy. 45 and Winchester Rd., Libertyville, Ill. 60048
Jefferson Chemical Co., P.O. Box 430, Bellaire, Tex. 77401 (subsidiary of Texaco)
Kaiser Chemicals, 300 Lakeside Dr., Oakland, Calif. 94643 (division of Kaiser Aluminum & Chemical Corp.)
Kay-Fries, Stony Point, N.Y. 10980 (owned by Dynamit Nobel A.G. of West Germany)
Kerr-McGee Chemical Corp., Kerr-McGee Ctr., Oklahoma City, Okla. 73125 (subsidiary of Kerr-McGee Corp.)
Kewanee Industries, P.O. Box 591, Bryn Mawr, Pa. 19010 (subsidiary of Gulf Oil Corp.)
Koppers Co., 1420 Koppers Bldg., Pittsburgh, Pa. 15219
Lawter Chemicals, 990 Skokie Blvd., Northbrook, Ill. 60062
Liquid Air Corp. of North America, 405 Lexington Ave., New York, N.Y. 10017
Liquid Carbonic Corp., 135 South La Salle St., Chicago, Ill. 60603 (subsidiary of Houston Natural Gas Corp.)
Lithium Corp. of America, 449 North Cox Rd., Gastonia, N.C. 28052 (subsidiary of Gulf Resources & Chemical Corp.)
Lonza, 22-10 Rte. 208, Fair Lawn, N.J. 07410 (owned by Lonza Ltd. of Switzerland)
Lubrizol Corp., 29400 Lakeland Blvd., Wickliffe, Ohio 44092
Mackenzie Chemical Works, 1 Cordeilo Ave., Central Islip, N.Y. 11722
Mallinckrodt, P.O. Box 5840, St. Louis, Mo. 63134
MC&B Manufacturing Chemists, 2909 Highland Ave., Norwood, Ohio 45212 (division of G. D. Searle & Co.)
Millmaster Chemical Co., 99 Park Ave., New York, N.Y. 10016 (subsidiary of Kewanee Industries)
Mobay Chemical Corp., Penn Lincoln Pkwy. West, Pittsburgh, Pa. 15205 (owned by Bayer A.G. of West Germany)
Mobil Chemical Co., 150 East 42nd St., New York, N.Y. 10017 (division of Mobil Oil Corp.)
Monsanto Co., 800 North Lindbergh Blvd., St. Louis, Mo. 63166
Morton Chemical Co., 110 North Wacker Dr., Chicago, Ill. 60606 (division of Morton-Norwich Products)
M&T Chemicals, Woodbridge Rd. and Randolph Ave., Rahway, N.J. 07065 (wholly owned subsidiary of Société Nationale Elf Aquitaine)
Nalco Chemical Co., 2901 Butterfield Rd., Oak Brook, Ill. 60521
National Distillers & Chemical Corp., 99 Park Ave., New York, N.Y. 10016
National Starch & Chemical Corp., 10 Finderne Ave., Bridgewater, N.J. 08807 (owned by Unilever of the U.K.)
Neville Chemical Co., 1938 Neville Island, Pittsburgh, Pa. 15225
New England Nuclear Corp., 549 Albany St., Boston, Mass. 02118
NL Industries, industrial chemicals division, P.O. Box 700, Hightstown, N.J. 08520
Northern Petrochemical Co., 2350 East Devon Ave., Des Plaines, Ill. 60018 (subsidiary of Northern Natural Gas Co.)
Norton Chemical Process Products division, P.O. Box 350, Akron, Ohio 44309 (division of Norton Co.)
Noury Chemical Corp., Rte. 78, Burt, N.Y. 14028 (subsidiary of Armak Co.)
Novamont Corp., 1114 Ave. of the Americas, New York, N.Y. 10036 (subsidiary of Montedison, S.p.A. of Italy)
Occidental Chemical Co., 2055 South Post Oak Rd., Houston, Tex. 77027 (subsidiary of Occidental Petroleum Corp.)
Olin Corp., 120 Long Ridge Rd., Stamford, Conn. 06904
Ott division, 500 Agard Rd., Muskegon, Mich. 49445 (division of Story Chemical Corp.)
Oxirane Corp., 4550 Post Oak Place Dr., Houston, Tex. 77027
Ozark-Mahoning Co., 1870 South Boulder Ave., Tulsa, Okla. 74119 (subsidiary of Pennwalt Corp.)
Pacific Resins & Chemicals, 1754 Thorne Rd., Tacoma, Wash. 98421 (subsidiary of Univar Corp.)
Pantasote Co., P.O. Box 1800, Greenwich, Conn. 06830
Pearsall Chemical Corp., P.O. Box 437, Houston, Tex. 77001
S. B. Penick & Co., 1050 Wall St. West, Lyndhurst, N.J. 07071 (unit of CPC International)
Pennwalt Corp., 3 Pkwy., Philadelphia, Pa. 19102
Petro-Tex Chemical Corp., 8600 Park Place Blvd., Houston, Tex. 77017 (affiliate of FMC Corp. and Tenneco)
Pfanstiehl Laboratories, 1219 Glen Rock Ave., Waukegan, Ill. 60085
Pfister Chemical, Linden Ave., Ridgefield, N.J. 07657
Philadelphia Quartz Co., P.O. Box 840, Valley Forge, Pa. 19482
Phillips Fibers Corp., P.O. Box 66, Greenville, S.C. 29602 (jointly owned by Phillips Petroleum Co. and Rhône-Poulenc S.A. of France)
Pierce Chemical Co., P.O. Box 117, Rockford, Ill. 61105
PPG Industries, 1 Gateway Ctr., Pittsburgh, Pa. 15222
Publicker Industries, 1429 Walnut St., Philadelphia, Pa. 19102
PVO International, World Trade Ctr., San Francisco, Calif. 94111
Quaker Oats Co., chemicals division, P.O. Box 3514, Chicago, Ill. 60654
Reichhold Chemicals, 523 North Broadway, White Plains, N.Y. 10603
Reilly Tar & Chemical Corp., 151 North Delaware St., Indianapolis, Ind. 46204
Rexene Polyolefins Co., P.O. Box 37, Paramus, N.J. 07652 (subsidiary of Dart Industries)
Rhodia, 600 Madison Ave., New York, N.Y. 10022 (subsidiary of Rhône-Poulenc S.A. of France)
Richardson Co., 2400 East Devon Ave., Des Plaines, Ill. 60018
Rilsan Corp., 139 Harristown Rd., Glen Rock, N.J. 07452 (owned by ATO Chimie of France)
F. Ritter & Co., 4001 Goodwin Ave., Los Angeles, Calif. 90039
Rohm & Haas Co., Independence Mall West, Philadelphia, Pa. 19105
R.S.A. Corp., 690 Saw Mill River Rd., Ardsley, N.Y. 10502
Rubicon Chemicals, P.O. Box 517, Geismar, La. 70734 (affiliated with ICI and Uniroyal)
Sandoz, Rte. 10, East Hanover, N.J. 07936 (owned by Sandoz Ltd. of Switzerland)
SCM Corp., 299 Park Ave., New York, N.Y. 10017
Shell Chemical Co., P.O. Box 2463, Houston, Tex. 77001 (division of Shell Oil Co.)
Shepherd Chemical Co., 4900 Beech St., Cincinnati, Ohio 45212
Stauffer Chemical Co., Nyala Farm Rd., Westport, Conn. 06880
Stepan Chemical Co., Edens and Winnetka Rd., Northfield, Ill. 60093
Sterling Organics, 90 Park Ave., New York, N.Y. 10016 (division of Sterling Drug)
Story Chemical Corp., 500 Agard Rd., Muskegon, Mich. 49445
Sun Chemical Corp., 200 Park Ave., New York, N.Y. 10017
Sybron Corp., 1100 Midtown Tower, Rochester, N.Y. 14604
Tenneco Chemicals, Park 80 Plaza West, Saddle Brook, N.J. 07662 (division of Tenneco)
Thompson-Hayward Chemical Co., 5200 Speaker Rd., Kansas City, Kan. 66106 (subsidiary of North American Philips Corp.)
Toms River Chemical Corp., P.O. Box 71, Toms River, N.J. 08753 (jointly owned by Ciba-Geigy Corp. and Sandoz Ltd. of Switzerland)
Union Carbide Corp., 270 Park Ave., New York, N.Y. 10017
Union Chemicals, 1345 North Meacham Rd., Schaumburg, Ill. 60196 (division of Union Oil Co. of California)
Uniroyal Chemical Co., Spencer St., Naugatuck, Conn. 06770 (division of Uniroyal)
United Nuclear Corp., 7700 Leesburg Pike, Falls Church, Va. 22043
U.S. Borax & Chemical Corp., 3075 Wilshire Blvd., Los Angeles, Calif. 90010 (owned by Rio Tinto Zinc Corp. of U.K.)
U.S. Industrial Chemicals Co., 99 Park Ave., New York, N.Y. 10016 (division of National Distillers & Chemical Corp.)
USM Corp., 140 Federal St., Boston, Mass. 02112 (subsidiary of Emhart Corp.)
USS Chemicals, 600 Grant St., Pittsburgh, Pa. 15230 (division of U.S. Steel Corp.)
Vanderbilt Chemical Corp., 30 Winfield St., Norwalk, Conn. 06855 (subsidiary of R. T. Vanderbilt Co.)
Velsicol Chemical Corp., 341 East Ohio St., Chicago, Ill. 60611 (subsidiary of Northwest Industries)
Ventron Corp., Congress St., Beverly, Mass. 01915 (subsidiary of Thiokol Corp.)
Verona Dyestuff division, P.O. Box 385, Union, N.J. 07083 (division of Mobay Chemical Corp.)
Virginia Chemicals, 3340 West Norfolk Rd., Portsmouth, Va. 23703
Vistron Corp., Midland Bldg., Cleveland, Ohio 44115 [subsidiary of Standard Oil Co. (Ohio)]
Vulcan Materials Co., P.O. Box 7689, Birmingham, Ala. 35223
West Chemical Products, 42-16 West St., Long Island City, N.Y. 11101 (subsidiary of West Argo Chemicals)
Williams Cos., 320 South Boston Ave., Tulsa, Okla. 74103
Witco Chemical Corp., 277 Park Ave., New York, N.Y. 10017

Drugs

Abbott Laboratories, 1400 Sheridan Rd., North Chicago, Ill. 60064
American Home Products Corp., 685 Third Ave., New York, N.Y. 10017
Ames Co., P.O. Box 70, Elkhart, Ind. 46515 (division of Miles Laboratories)
Armour Pharmaceutical Co., P.O. Box 1849, Scottsdale, Ariz. 85252 (subsidiary of Revlon)
Ayerst Laboratories, 685 Third Ave., New York, N.Y. 10017 (division of American Home Products Corp.)
Baxter Travenol Laboratories, Baxter Pkwy., Deerfield, Ill. 60015
Breon Laboratories, 90 Park Ave., New York, N.Y. 10016 (subsidiary of Sterling Drug)
Bristol Laboratories, P.O. Box 657, Syracuse, N.Y. 13201 (division of Bristol-Myers Co.)
Bristol-Myers Co., 345 Park Ave., New York, N.Y. 10022
Burroughs Wellcome Co., 3030 Cornwallis Rd., Research Triangle Park, N.C. 27709 (owned by Wellcome Foundation Ltd. of U.K.)
Carter-Wallace, 767 Fifth Ave., New York, N.Y. 10022
Ciba-Geigy Corp., pharmaceuticals division, 556 Morris Ave., Summit, N.J. 07901 (owned by Ciba-Geigy Ltd. of Switzerland)
Cooper Laboratories, 1259 Rte. 46, Parsippany, N.J. 07054
Cutter Laboratories, Fourth and Parker St., Berkeley, Calif. 94710 (owned by Bayer A.G. of West Germany)
Dorsey Laboratories, P.O. Box 83288, Lincoln, Neb. 68501 (division of Sandoz)
Endo Laboratories, 1000 Stewart Ave., Garden City, N.Y. 11530 (subsidiary of Du Pont)
Ethicon, U.S. Hwy. 22, Somerville, N.J. 08876 (subsidiary of Johnson & Johnson)
Ganes Chemicals, 1114 Ave. of the Americas, New York, N.Y. 10036 (owned by Siegfried Ltd. of Switzerland)
Hoechst-Roussel Pharmaceuticals, Rte. 202-206 North, Somerville, N.J. 08876 (subsidiary of American Hoechst Corp.)
Hoffmann-La Roche, 340 Kingsland Rd., Nutley, N.J. 07110 (member of Hoffmann-La Roche Group of Switzerland)
ICN Pharmaceuticals, 2727 Campus Dr., Irvine, Calif. 92664
Inolex Pharmaceutical, 2600 Bond St., Park Forest South, Ill. 60466 (division of Inolex Corp.)

Directory

Lederle Laboratories, North Middletown Rd., Pearl River, N.Y. 10965 (division of American Cyanamid Co.)
Eli Lilly & Co., 307 East McCarty St., Indianapolis, Ind. 46206
Marion Laboratories, 10236 Bunker Ridge Rd., Kansas City, Mo. 64137
McNeil Laboratories, Camp Hill Rd., Fort Washington, Pa. 19034 (subsidiary of Johnson & Johnson)
Mead Johnson & Co., 2400 Pennsylvania St., Evansville, Ind. 47721 (subsidiary of Bristol-Myers Co.)
Merck & Co., P.O. Box 2000, Rahway, N.J. 07065
Merrell-National Laboratories, 110 East Amity Rd., Cincinnati, Ohio 45215 (division of Richardson-Merrell)
Miles Laboratories, P.O. Box 40, Elkhart, Ind. 46515 (owned by Bayer A.G. of West Germany)
Morton-Norwich Products, 110 North Wacker Dr., Chicago, Ill. 60606
Norwich-Eaton Pharmaceuticals, 17 Eaton Ave., Norwich, N.Y. 13815 (division of Morton-Norwich Products)
Organon, 375 Mt. Pleasant Ave., West Orange, N.J. 07052 (subsidiary of Akzona)
Ortho Pharmaceutical Corp., Raritan, N.J. 08869 (subsidiary of Johnson & Johnson)
Parke, Davis & Co., P.O. Box 118, G.P.O., Detroit, Mich. 48232 (subsidiary of Warner-Lambert Co.)
Pfizer, 235 East 42nd St., New York, N.Y. 10017
Philips Roxane Laboratories, 330 Oak St., Columbus, Ohio 43216 (subsidiary of North American Philips Corp.)
Purdue Frederick Co., 50 Washington St., Norwalk, Conn. 06856
Rachelle Laboratories, 700 Henry Ford Ave., Long Beach, Calif. 90801
Richardson-Merrell, 10 Westport Rd., Wilton, Conn. 06897
Riker Laboratories, 19901 Nordhoff St., Northridge, Calif. 91324 (subsidiary of 3M Co.)
A. H. Robins Co., 1407 Cummings Dr., Richmond, Va. 23220
Wm. H. Rorer, 500 Virginia Dr., Fort Washington, Pa. 19034 (subsidiary of Rorer Group)
Sandoz Pharmaceuticals, Rte. 10, East Hanover, N.J. 07936 (division of Sandoz)
R. P. Scherer Corp., 9425 Grinnell Ave., Detroit, Mich. 48213
Schering-Plough Corp., Galloping Hill Rd., Kenilworth, N.J. 07033
G. D. Searle & Co., P.O. Box 1045, Skokie, Ill. 60076
SmithKline Corp., 1500 Spring Garden St., Philadelphia, Pa. 19101
E. R. Squibb & Sons, P.O. Box 4000, Princeton, N.J. 08540 (subsidiary of Squibb Corp.)
Sterling Drug, 90 Park Ave., New York, N.Y. 10016
Stuart Pharmaceuticals, 3411 Silverside Rd., Wilmington, Del. 19897 (division of ICI United States)
Syntex Laboratories, 3401 Hillview Ave., Palo Alto, Calif. 94304
Upjohn Co., 7000 Portage Rd., Kalamazoo, Mich. 49001
USV Laboratories, 1 Scarsdale Rd., Tuckahoe, N.Y. 10707 (division of Revlon)
Wallace Laboratories, Half Acre Rd., Cranbury, N.J. 08512 (division of Carter-Wallace)
Warner-Lambert Co., 201 Tabor Rd., Morris Plains, N.J. 07950
Westwood Pharmaceuticals, 468 Dewitt St., Buffalo, N.Y. 14213
Winthrop Laboratories, 90 Park Ave., New York, N.Y. 10016 (division of Sterling Drug)
Wyeth Laboratories, P.O. Box 8299, Philadelphia, Pa. 19101 (division of American Home Products Corp.)

Personal-care products

Alberto Culver Co., 2525 Armitage Ave., Melrose Park, Ill. 60160
Avon Products, 9 West 57th St., New York, N.Y. 10019
Chesebrough-Ponds, 33 Benedict Pl., Greenwich, Conn. 06830
Clairol, 345 Park Ave., New York, N.Y. 10022 (subsidiary of Bristol-Myers Co.)
Colgate-Palmolive Co., 300 Park Ave., New York, N.Y. 10022
Faberge, 310 East 44th St., New York, N.Y. 10019
Max Factor & Co., 1655 McCadden Pl., Hollywood, Calif. 90028 (subsidiary of Norton Simon)
Gillette Co., Prudential Tower Bldg., Boston, Mass. 02199
Andrew Jergens Co., 2535 Spring Grove Ave., Cincinnati, Ohio 45214 (subsidiary of American Brands)
Lever Brothers Co., 390 Park Ave., New York, N.Y. 10022 (owned by Unilever of the U.K.)
Noxell Corp., P.O. Box 1799, Baltimore, Md. 21203
Procter & Gamble Co., P.O. Box 599, Cincinnati, Ohio 45201
Purex Corp., 5101 Clark Ave., Lakewood, Calif. 90712
Revlon, 767 Fifth Ave., New York, N.Y. 10022
Shulton, 697 U.S. Hwy. 46, Clifton, N.J. 07015 (subsidiary of American Cyanamid Co.)

Coatings

Baltimore Paint & Chemical Corp., 2325 Hollins Ferry Rd., Baltimore, Md. 21230 (subsidiary of ELT)
Carboline Co., 350 Hanley Industrial Court, St. Louis, Mo. 63144
Cook Paint & Varnish Co., 1412 Knox St., North Kansas City, Mo. 64116
DeSoto, 1700 South Mt. Prospect Rd., Des Plaines, Ill. 60018
Dutch Boy, 500 Central Ave., Northfield, Ill. 60093
Glidden Coatings & Resins, 900 Union Commerce Tower, Cleveland, Ohio 44115 (division of SCM Corp.)
Guardsman Chemicals, 1350 Steele Ave., Southwest, Grand Rapids, Mich. 49507
Lilly Industrial Coatings, 666 South California St., Indianapolis, Ind. 46225
Benjamin Moore & Co., 51 Chestnut Ridge Rd., Montvale, N.J. 07645
O'Brien Corp., P.O. Box 4037, South Bend, Ind. 46634
Porter Paint Co., 13th and Walnut St., Louisville, Ky. 40201
Pratt & Lambert, P.O. Box 22, Buffalo, N.Y. 14240
Sherwin-Williams Co., 101 Prospect Ave., N.W., Cleveland, Ohio 44101
Valspar Corp., 1101 Third St. South, Minneapolis, Minn. 55415

Petroleum

Amerada Hess Corp., 1 Hess Plaza, Woodbridge, N.J. 07095
American Petrofina, P.O. Box 2159, Dallas, Tex. 75221
Ashland Oil, P.O. Box 391, Ashland, Ky. 41101
Atlantic Richfield Co., 515 South Flower St., Los Angeles, Calif. 90071
Cities Service Co., 110 West Seventh St., Tulsa, Okla. 74102
Clark Oil & Refining Corp., 8530 West National Ave., Milwaukee, Wis. 53201
Continental Oil Co., High Ridge Park, Stamford, Conn. 06904
Cosden Oil & Chemical Co., P.O. Box 1311, Big Spring, Tex. 79720 (subsidiary of American Petrofina)
Exxon Corp., 1251 Ave. of the Americas, New York, N.Y. 10020
Getty Oil Co., 3810 Wilshire Blvd., Los Angeles, Calif. 90010
Gulf Oil Corp., Gulf Bldg., Pittsburgh, Pa. 15219
Kerr-McGee Corp., Kerr-McGee Ctr., Oklahoma City, Okla. 73125
Marathon Oil Co., 539 South Main St., Findlay, Ohio 45840
Mobil Oil Corp., 150 East 42nd St., New York, N.Y. 10017
Murphy Oil Corp., 200 Jefferson Ave., El Dorado, Ark. 71730
Occidental Petroleum Corp., 10889 Wilshire Blvd., Los Angeles, Calif. 90024
Pennzoil Co., 900 Southwest Tower, Houston, Tex. 77002
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla. 74004
Quaker State Oil Refining Corp., P.O. Box 989, Oil City, Pa. 16301
Shell Oil Co., 1 Shell Plaza, Houston, Tex. 77002
Standard Oil Co. of California, 225 Bush St., San Francisco, Calif. 94104
Standard Oil Co. (Ind.), 200 East Randolph Dr., Chicago, Ill. 60680
Standard Oil Co. (Ohio), Midland Bldg., Cleveland, Ohio 44115
Sun Co., 100 Matsonford Rd., Radnor, Pa. 19807
Tenneco, P.O. Box 2511, Houston, Tex. 77001
Texaco, 2000 Westchester Ave., White Plains, N.Y. 10650
Union Oil Co. of California, Union Oil Ctr., Los Angeles, Calif. 90017

Rubber

American Biltrite, 575 Technology Sq., Cambridge, Mass. 02139
Amstrong Rubber Co., 500 Sargent Dr., New Haven, Conn. 06507
Carlisle Corp., 511 Walnut St., Cincinnati, Ohio 45202
Cooper Tire & Rubber Co., Lima and Western Ave., Findlay, Ohio 45840
Firestone Tire & Rubber Co., 1200 Firestone Pkwy., Akron, Ohio 44317
Gates Rubber Co., 999 South Broadway, Denver, Colo. 80217
General Tire & Rubber Co., 1 General St., Akron, Ohio 44329
B. F. Goodrich Co., 500 South Main St., Akron, Ohio 44318
Goodyear Tire & Rubber Co., 1144 East Market St., Akron, Ohio 44316
Mohawk Rubber Co., 50 Executive Pkwy., Hudson, Ohio 44236
St. Clair Rubber Co., 107 Clifford St., Detroit, Mich. 48226
Uniroyal, 1230 Ave. of the Americas, New York, N.Y. 10020

Paper and forest products

Bemis Co., 800 Northstar Ctr., Minneapolis, Minn. 55402
Boise Cascade Corp., P.O. Box 50, Boise, Idaho 83728
Champion International Corp., 1 Banamark Sq., Stamford, Conn. 06921
Charmin Paper Products Co., 800 University Ave., Green Bay, Wis. 54302 (subsidiary of Procter & Gamble Co.)
Consolidated Papers, First Ave. North, Wisconsin Rapids, Wis. 54494
Container Corp. of America, 1 First National Plaza, Chicago, Ill. 60670 (subsidiary of Marcor)
Continental Forest Industries, Greenwich Office Park 2, Greenwich, Conn. 06830 (member of Continental Group)
Crown Zellerbach Corp., 1 Bush St., San Francisco, Calif. 94119
Diamond International Corp., 733 Third Ave., New York, N.Y. 10017
Georgia-Pacific Corp., 900 Southwest Fifth Ave., Portland, Ore. 97204
Great Northern Nekoosa Corp., 75 Prospect St., Stamford, Conn. 06901
Hammermill Paper Co., 1442 East Lake Rd., Erie, Pa. 16533
Inland Container Corp., 151 North Delaware St., Indianapolis, Ind. 46206
International Paper Co., 220 East 42nd St., New York, N.Y. 10017
ITT Rayonier, 605 Third Ave. New York, N.Y. 10016 (subsidiary of International Telephone & Telegraph Corp.)
Kimberly-Clark Corp., 128 North Lake St., Neenah, Wis. 54956
Mead Corp., Courthouse Plaza Northeast, Dayton, Ohio 45463
Potlatch Corp., 1 Maritime Plaza, San Francisco, Calif. 94111
St. Regis Paper Co., 150 East 42nd St., New York, N.Y. 10017
Scott Paper Co., Scott Plaza, Philadelphia, Pa. 19113
Union Camp Corp., 1600 Valley Rd., Wayne, N.J. 07470
Westvaco Corp., 299 Park Ave., New York, N.Y. 10017
Weyerhaeuser Co., Tacoma, Wash. 98401

Metals and minerals

Allegheny Ludlum Industries, Oliver Bldg., Mellon Sq., Pittsburgh, Pa. 15222
Allied-Kelite Products division, 2400 East Devon Ave., Des Plaines, Ill. 60018 (division of Richardson Co.)
Aluminum Co. of America, 1126 Alcoa Bldg., Pittsburgh, Pa. 15219
Amax, Amax Ctr., Greenwich, Conn. 06830
Anaconda Co., 1271 Ave. of the Americas, New York, N.Y. 10020 (subsidiary of Atlantic Richfield Co.)
Armco, P.O. Box 600, Middletown, Ohio 45043
Asarco, 120 Broadway, New York, N.Y. 10005
Basic Chemicals, 845 Hanna Bldg., Cleveland, Ohio 44115 (division of Basic)
Bethlehem Steel Corp., 701 East Third St., Bethlehem, Pa. 18016
Carpenter Technology Corp., 150 West Bern St., Reading, Pa. 19603

Cerro Metal Products, P.O. Box 388, Bellefonte, Pa. 16823 (division of Marmon Group)
Chromalloy American Corp., 120 South Central Ave., St. Louis, Mo. 63105
Climax Molybdenum Co., 1 Greenwich Plaza, Greenwich, Conn. 06830 (division of Amax)
Colt Industries, 430 Park Ave., New York, N.Y. 10022
Copperweld Bimetallics division, 100 Ninth St., Glassport, Pa. 15045 (division of Copperweld Corp.)
Cyclops Corp., 650 Washington Rd., Pittsburgh, Pa. 15228
Duval Corp., P.O. Box 2967, Houston, Tex. 77001 (subsidiary of Pennzoil Co.)
Engelhard Minerals & Chemicals Corp., 70 Wood Ave. South, Iselin, N.J. 08830
Fansteel, 1 Tantalum Pl., North Chicago, Ill. 60064
Foote Mineral Co., Rte. 100, Exton, Pa. 19341
Freeport Minerals Co., 161 East 42nd St., New York, N.Y. 10017
Gulf Resources & Chemical Corp., 1100 Milam Bldg., Houston, Tex. 77002
Handy & Harman, 850 Third Ave., New York, N.Y. 10022
Howmet Aluminum Corp., 475 Steamboat Rd., Greenwich, Conn. 06830 (affiliate of Pechiney Ugine of France)
Inland Steel Co., 30 West Monroe St., Chicago, Ill. 60603
Interlake, 135th St. and Perry Ave., Chicago, Ill. 60027
International Nickel Co., 1 New York Plaza, New York, N.Y. 10004
Jones & Laughlin Steel Corp., 3 Gateway Ctr., Pittsburgh, Pa. 15263 (owned by LTV Corp.)
Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland, Calif. 94643
Kaiser Steel Corp., 300 Lakeside Dr., Oakland, Calif. 94643 (affiliate of Kaiser Industries Corp.)
Kawecki Berylco Industries, 220 East 42nd St., New York, N.Y. 10017
Kennametal, P.O. Box 346, Latrobe, Pa. 15650
Kennecott Copper Corp., 161 East 42nd St., New York, N.Y. 10017
Martin Marietta Aluminum, 6801 Rockledge Dr., Bethesda, Md. 20034 (subsidiary of Martin Marietta Corp.)
Matthey Bishop, 4 Malin Rd., Malvern, Pa. 19355 (affiliate of Johnson Matthey & Co. of the U.K.)
McLouth Steel Corp., 300 South Livernois Ave., Detroit, Mich. 48209
Molycorp, 6 Corporate Park Dr., White Plains, N.Y. 10604 (affiliate of Union Oil Co. of California)
National Steel Corp., 2800 Grant Bldg., Pittsburgh, Pa. 15219
New Jersey Zinc Co., 2 University Plaza, Hackensack, N.J. 07601 (division of Gulf & Western Industries)
Phelps Dodge Refining Corp., P.O. Box 1126, Wall St. Station, New York, N.Y. 10005 (subsidiary of Phelps Dodge Corp.)
Republic Steel Corp., P.O. Box 6778, Cleveland, Ohio 44101
Revere Copper & Brass, 605 Third Ave., New York, N.Y. 10016
Reynolds Metals Co., P.O. Box 27003, Richmond, Va. 23261
St. Joe Minerals Corp., 250 Park Ave., New York, N.Y. 10017
Teledyne Wah Chang Albany, P.O. Box 460, Albany, Ore. 97321 (subsidiary of Teledyne)
Texasgulf, High Ridge Park, Stamford, Conn. 06904
Titanium Metals Corp. of America, P.O. Box 2824, Pittsburgh, Pa. 15230
United States Steel Corp., 600 Grant St., Pittsburgh, Pa. 15230

Food

American Maize-Products Co., 113th St. and Indianapolis Blvd., Hammond, Ind. 46326
Amstar Corp., 1251 Ave. of the Americas, New York, N.Y. 10020
Anderson Clayton Foods, P.O. Box 6165, Dallas, Tex. 75222 (division of Anderson Clayton & Co.)
Archer Daniels Midland Co., P.O. Box 1470, Decatur, Ill. 62525
Armour & Co., Greyhound Tower, Phoenix, Ariz. 85077 (subsidiary of Greyhound Corp.)
Beatrice Foods Co., 120 South La Salle St., Chicago, Ill. 60603
Borden, 180 East Broad St., Columbus, Ohio 43215
Campbell Soup Co., Campbell Pl., Camden, N.J. 08101
Carnation Co., 5045 Wilshire Blvd., Los Angeles, Calif. 90036
Central Soya Co., 1300 Ft. Wayne National Bank Bldg., Ft. Wayne, Ind. 46802
Consolidated Foods Corp., 135 South La Salle St., Chicago, Ill. 60603
CPC International, International Plaza, Englewood Cliffs, N.J. 07632
Cudahy Co., 100 West Clarendon St., Phoenix, Ariz. 85013 (subsidiary of General Host Corp.)
Del Monte Corp., P.O. Box 3575, San Francisco, Calif. 94119
Esmark, 55 East Monroe St., Chicago, Ill. 60603
General Foods Corp., 250 North St., White Plains, N.Y. 10625
General Mills, P.O. Box 1113, Minneapolis, Minn. 55440
Gerber Products Co., Fremont, Mich. 49412
Heinz U.S.A., P.O. Box 57, Pittsburgh, Pa. 15230
Hershey Foods Corp., 19 East Chocolate Ave., Hershey, Pa. 17033
Geo. A. Hormel & Co., Austin, Minn. 55912
Kellogg Co., 235 Porter St., Battle Creek, Mich. 49016
Kraft, Kraft Court, Glenview, Ill. 60025
Libby, McNeill & Libby, 200 South Michigan Ave., Chicago, Ill. 60604
Thomas J. Lipton, 800 Sylvan Ave., Englewood Cliffs, N.J. 07632
McCormick & Co., 11350 McCormick Rd., Hunt Valley, Md. 21031
Nabisco, River Rd., East Hanover, N.J. 07936
Norton Simon, 277 Park Ave., New York, N.Y. 10017
Pepperidge Farm, P.O. Box 5500, Norwalk, Conn. 06856 (subsidiary of Campbell Soup Co.)
Pet, 400 South Fourth St., St. Louis, Mo. 63166
Pillsbury Co., 608 Second Ave., South, Minneapolis, Minn. 55402
Quaker Oats Co., P.O. Box 3514, Chicago, Ill. 60654
Ralston Purina Co., 835 South Eighth St., St. Louis, Mo. 63188
A. E. Staley Mfg. Co., P.O. Box 151, Decatur, Ill. 62525
Standard Brands, 625 Madison Ave., New York, N.Y. 10022
Stokely-Van Camp, 941 North Meridian St., Indianapolis, Ind. 46206
Swift & Co., 115 West Jackson Blvd., Chicago, Ill. 60604 (subsidiary of Esmark)
Universal Foods Corp., 433 East Michigan St., Milwaukee, Wis. 53201
Wm. Wrigley Jr. Co., 410 North Michigan Ave., Chicago, Ill. 60611

Other manufacturers

Abcor, 850 Main St., Wilmington, Mass. 01887
Addressograph Multigraph Corp., 1900 Ave. of the Stars, Los Angeles, Calif. 90067
Aerojet-General Corp., 9100 East Flair Dr., El Monte, Calif. 91734 (subsidiary of General Tire & Rubber Co.)
Allis-Chalmers Corp., P.O. Box 512, Milwaukee, Wis. 53201
Alza Corp., 950 Page Mill Rd., Palo Alto, Calif. 94304
American Air Filter Co., 200 Central Ave., Louisville, Ky. 40277
American Brands, 245 Park Ave., New York, N.Y. 10017
American Can Co., American Lane, Greenwich, Conn. 06830
American Hospital Supply Corp., 1740 Ridge Ave., Evanston, Ill. 60204
American Motors Corp., 14250 Plymouth Rd., Detroit, Mich. 48232
American Optical Corp., 14 Mechanic St., Southbridge, Mass. 01550 (subsidiary of Warner-Lambert Co.)
American Standard, 40 West 40th St., New York, N.Y. 10018
American Telephone & Telegraph Co., 195 Broadway, New York, N.Y. 10007
AMF World Tobacco Group, 689 Hope St., Stamford, Conn. 06907
AMP, P.O. Box 3608, Harrisburg, Pa. 17105
Ampex Corp., 401 Broadway, Redwood City, Calif. 94063
Analabs, 82 Republic Dr., North Haven, Conn. 06473 (subsidiary of New England Nuclear Corp.)
Anchor Hocking Corp., 70 Glass Ave., Lancaster, Ohio 43130
Anheuser-Busch, 721 Pestalozzi St., St. Louis, Mo. 63118
Armstrong Cork Co., 1010 Concord St., Lancaster, Pa. 17604
Atlantic Research Corp., 5390 Cherokee Ave., Alexandria, Va. 22314
Avco Corp., 1275 King St., Greenwich, Conn. 06830
Babcock & Wilcox Co., P.O. Box 1126, Wall St. Station, New York, N.Y. 10017
Badger Co., 1 Broadway, Cambridge, Mass. 02142 (division of Raytheon Co.)
Baird-Atomic, 125 Middlesex Tpke., Bedford, Mass. 01730
Bausch & Lomb, 1 Lincoln First Sq., Rochester, N.Y. 14601
Beckman Instruments, 2500 Harbor Blvd., Fullerton, Calif. 92634
Becton, Dickinson & Co., Rutherford, N.J. 07070
Bell & Howell Co., 7100 McCormick Rd., Chicago, Ill. 60645
Bendix Corp., Bendix Ctr., Southfield, Mich. 48076
Bio-Dynamics, 9115 Hague Rd., Indianapolis, Ind. 46250
Blaw-Knox Co., 1 Oliver Plaza, Pittsburgh, Pa. 15222 (division of White Consolidated Industries)
Borg-Warner Corp., 200 South Michigan Ave., Chicago, Ill. 60604
Bostik, Middleton, Mass. 01949 (division of USM Corp.)
Bruning, 1834 Walden Office Sq., Schaumburg, Ill. 60196 (division of Addressograph Multigraph Corp.)
Budd Co., 3155 West Big Beaver Rd., Troy, Mich. 48084
Burlington Industries, P.O. Box 21207, Greensboro, N.C. 27420
Burroughs Corp., Burroughs Pl., Detroit, Mich. 48232
Carborundum Co., P.O. Box 337, Niagara Falls, N.Y. 14302 (subsidiary of Kennecott Copper Corp.)
Cargill, Cargill Bldg., Minneapolis, Minn. 55402
Caterpillar Tractor Co., 100 N.E. Adams St., Peoria, Ill. 61629
Celotex Corp., 1500 North Dale Mabry Hwy., Tampa, Fla. 33607 (division of Jim Walter Corp.)
Chemical Construction Corp., 1 Penn Plaza, New York, N.Y. 10001 (division of Aerojet General Corp.)
Chemical Products Corp., P.O. Box 449, Cartersville, Ga. 30120
Chrysler Corp., P.O. Box 1919, Detroit, Mich. 48288
C&I Girdler, P.O. Box 32940, Louisville, Ky. 40232 (division of Bechtel Corp.)
Combustion Engineering, 900 Long Ridge Rd., Stamford, Conn. 06902
Continental Can Co. U.S.A., 5747 East River Rd., Chicago, Ill. 60631 (member of Continental Group)
Coors Porcelain Co., 600 Ninth St., Golden, Colo. 80401 (division of Adolph Coors Co.)
Corning Glass Works, 80 Houghton Park, Corning, N.Y. 14830
Crown Cork & Seal Co., 9300 Ashton Rd., Philadelphia, Pa. 19136
Curtiss-Wright Corp., 1 Passaic St., Wood-Ridge, N.J. 07075
Dade division, 1851 Delaware Pkwy., Miami, Fla. 33152 (division of American Hospital Supply Corp.)
Dan River International Corp., 111 West 40th St., New York, N.Y. 10018
Dayco Corp., 333 West First St., Dayton, Ohio 45402
Deere & Co., John Deere Rd., Moline, Ill. 61265
Dorr-Oliver, 77 Havemeyer La., Stamford, Conn. 06904 (subsidiary of Curtiss-Wright Corp.)
Dresser Industries, 1505 Elm St., Dallas, Tex. 75201
Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650
El Paso Co., P.O. Box 2185, Houston, Tex. 77001
ESB, 5 Penn Ctr. Plaza, Philadelphia, Pa. 19103
Evans Products Co., P.O. Box 3295, Portland, Ore. 97208
Fairchild Camera & Instrument Corp., 464 Ellis St., Mountain View, Calif. 94042
Fasson, 252 Chester St., Painesville, Ohio 44077 (division of Avery International Co.)
Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa. 15219
Flintkote Co., 1351 Washington Blvd., Stamford, Conn. 06902
Fluor Corp., 2500 South Atlantic Blvd., Los Angeles, Calif. 90040
Ford, Bacon & Davis, 2 Broadway, New York, N.Y. 10004
Ford Motor Co., American Rd., Dearborn, Mich. 48127
Foremost-McKesson, 1 Post St., San Francisco, Calif. 94104

Directory

Foster Wheeler Corp., 110 South Orange Ave., Livingston, N.J. 07039
Foxboro Co., 86 Neponset Ave., Foxboro, Mass. 02035
Franklin GNO Corp., P.O. Box 3206, West Palm Beach, Fla. 33402
H. B. Fuller Co., 2400 Kasota Ave., St. Paul, Minn. 55108
GATX Corp., 120 South Riverside Plaza, Chicago, Ill. 60606
General Dynamics Corp., Pierre Laclede Ctr., St. Louis, Mo. 63105
General Electric Co., 1 River Rd., Schenectady, N.Y. 12345
General Motors Corp., 3044 West Grand Blvd., Detroit, Mich. 48202
General Resource Corp., 201 Third St. South, Hopkins, Minn. 55343
General Telephone & Electronics Corp., 1 Stamford Forum, Stamford, Conn. 06904
Globe-Union, 5757 North Green Bay Ave., Milwaukee, Wis. 53201
Grain Processing Corp., P.O. Box 341, Muscatine, Iowa 52761
Greyhound Corp., 111 West Clarendon Ave., Pheonix, Ariz. 85013
Grumman Corp., 1111 Stewart Ave., Bethpage, Long Island, N.Y. 11714
Gulf & Western Industries, 1 Gulf & Western Plaza, New York, N.Y. 10023
G&W Electric Specialty Co., 3544 West 127th St., Blue Island, Ill. 60406
Honeywell, Honeywell Plaza at 27th St., Minneapolis, Minn. 55408
Horizons, 23800 Mercantile Rd., Cleveland, Ohio 44122 (affiliated with Horizons Research)
Houston Natural Gas Corp., P.O. Box 1188, Houston, Tex. 77001
Indian Head, 1211 Ave. of the Americas, New York, N.Y. 10036
Instrumentation Laboratory, 113 Hartwell Ave., Lexington, Mass. 02173
International Business Machines Corp., Old Orchard Rd., Armonk, N.Y. 10504
International Harvester Co., 401 North Michigan Ave., Chicago, Ill. 60611
International Playtex, 888 Seventh Ave., New York, N.Y. 10019 (division of Esmark)
Interface Corp., 260 Cherry Hill Rd., Parsippany, N.J. 07054
Ionics, 65 Grove St., Watertown, Mass. 02172
Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173
Johns-Manville Corp., P.O. Box 5108, Denver, Colo. 80217
S. C. Johnson & Son, 1525 Howe St., Racine, Wis. 53403
Johnson & Johnson, 501 George St., New Brunswick, N.J. 08903
Jones-Blair Co., P.O. Box 35286, Dallas, Tex. 75235
Leeds & Northrup Co., Sumneytown Pike, North Wales, Pa. 19454
Libbey-Owens-Ford Co., 811 Madison Ave., Toledo, Ohio 43695
Liggett Group, 4100 Roxboro Rd., Durham, N.C. 27702
Litton Industries, 360 North Crescent Dr., Beverly Hills, Calif. 90210
Lockheed Aircraft Corp., 2555 North Hollywood Way, Burbank, Calif. 91503
Loctite Corp., 999 North Mountain Rd., Newington, Conn. 06111
P. Lorillard Co., 200 East 42nd St., New York, N.Y. 10017 (subsidiary of Loews Corp.)
LTV Corp., 1525 Elm St., Dallas, Tex. 75201
Lummus Co., 1515 Broad St., Bloomfield, N.J. 07003 (subsidiary of Combustion Engineering)
3M Co., 3M Ctr., St. Paul, Minn. 55101
P. R. Mallory & Co., 3029 East Washington St., Indianapolis, Ind. 46206
Marcor, 535 West Chicago Ave., Chicago, Ill. 60610
Martin Marietta Corp., 6801 Rockledge Dr., Bethesda, Md. 20034
Masonite Corp., 29 North Wacker Dr., Chicago, Ill. 60606
McDonnell Douglas Corp., P.O. Box 516, St. Louis, Mo. 63166
McGaw Laboratories, 1015 Grandview Ave., Glendale, Calif. 91201 (division of American Hospital Supply Corp.)
Arthur G. McKee & Co., 6200 Oak Tree Blvd., Cleveland, Ohio 44131 (subsidiary of McKee Corp.)
Meloy Laboratories, 6715 Electronics Dr., Springfield, Va. 22151 (subsidiary of Revlon)
Millipore Corp., Wiggins Ave., Bedford, Mass. 01730
Mine Safety Appliances Co., 608 Penn Center Blvd., Pittsburgh, Pa. 15235
Philip Morris, 100 Park Ave., New York, N.Y. 10017
Motorola, 1303 East Algonquin Rd., Schaumburg, Ill. 60196
MRC Corp., 11212 McCormick Rd., Hunt Valley, Md. 21301
Nashua Corp., 44 Franklin St., Nashua, N.H. 03060
National Can Corp., 5959 South Cicero Ave., Chicago, Ill. 60638
National Gypsum Co., 4100 First International Bldg., Dallas, Tex. 75270
NCR Corp., 1700 South Patterson Blvd., Dayton, Ohio 45479
Nicolet, Wissahickon Ave., Ambler, Pa. 19002
NL Industries, 111 Broadway, New York, N.Y. 10006
Northern Natural Gas Co., 2223 Dodge St., Omaha, Neb. 68102
Norton Co., 50 New Bond St., Worcester, Mass. 01606
Owens-Corning Fiberglas Corp., Fiberglas Tower, Toledo, Ohio 43659 (jointly owned by Owens-Illinois and Corning Glass Works)
Owens-Illinois, P.O. Box 1035, Toledo, Ohio 43666
Para-Chem, Ontario and Roter St., Philadelphia, Pa. 19114
Parkson Corp., 5601 Northeast 14th Ave., Ft. Lauderdale, Fla. 33334 (subsidiary of A. Johnson Co.)
Ralph M. Parsons Co., 100 West Walnut St., Pasedena, Calif. 91124
PCR, P.O. Box 1466, Gainesville, Fla. 32601
Perkin-Elmer Corp., Main Ave., Norwalk, Conn. 06856
Petrolite Corp., 100 North Broadway, St. Louis, Mo. 63102
Pierce & Stevens Chemical Corp., 724 Ohio St., Buffalo, N.Y. 14203 (division of Pratt & Lambert)
Polaroid Corp., 549 Technology Sq., Cambridge, Mass. 02139
Polymer Applications, 3443 River Rd., Tonawanda, N.Y. 14150
Polymer Industries, Viaduct Rd., Stamford, Conn. 06907 (subsidiary of Philip Morris)
Pratt & Whitney Aircraft Group, 400 Main St., East Hartford, Conn. 06108 (division of United Technologies Corp.)
Pullman Power Products, P.O. Box 3308, Williamsport, Pa. 17701 (division of Pullman)
Radiation Management Corp., 3508 Market St., Philadelphia, Pa. 19104
Raychem Corp., 300 Constitution Dr., Menlo Park, Calif. 94025
RCA Corp., 30 Rockefeller Plaza, New York, N.Y. 10020
Research-Cottrell, P.O. Box 1500, Somerville, N.J. 08876
R. J. Reynolds Industries, 401 North Main St., Winston-Salem, N.C. 27102
H. H. Robertson Co., 400 Holiday Dr., Pittsburgh, Pa. 15220
Rockwell International Corp., 600 Grant St., Pittsburgh, Pa. 15219
Sargent-Welch Scientific Co., 7300 North Linder Ave., Skokie, Ill. 60076
Jos. Schlitz Brewing Co., 235 West Galena St., Milwaukee, Wis. 53201
Schwarz/Mann, Mountain View Ave., Orangeburg, N.Y. 10962 (division of Becton, Dickinson & Co.)
Scientific Design Co., 2 Park Ave., New York, N.Y. 10016 (subsidiary of Halcon International)
SCM Corp., 299 Park Ave., New York, N.Y. 10017
Sears, Roebuck & Co., Sears Tower, Chicago, Ill. 60684
Signal Cos., 9665 Wilshire Blvd., Beverly Hills, Calif. 90212
Singer Co., 30 Rockefeller Plaza, New York, N.Y. 10020
Spectra-Physics, 1250 West Middlefield Rd., Mountain View, Calif. 94042
Sprague Electric Co., 149 Marshall St., North Adams, Mass. 01247 (subsidiary of General Cable Corp.)
J. P. Stevens & Co., 1185 Ave. of the Americas, New York, N.Y. 10036
Stone & Webster Engineering Corp., P.O. Box 2325, Boston, Mass. 02107 (subsidiary of Stone & Webster)
Swedlow, 12122 Western Ave., Garden Grove, Calif. 92642
Teepak, 2 North Riverside Plaza, Chicago, Ill. 60606 (member of Continental Group)
Tektronix, P.O. Box 500, Beaverton, Ore. 97077
Texas Instruments, P.O. Box 5012, Dallas, Tex. 75222
Thiokol Corp., P.O. Box 1000, Newtown, Pa. 18940
U.S. Gypsum Co., 101 South Wacker Dr., Chicago, Ill. 60606
United Technologies Corp., 1 Financial Plaza, Hartford, Conn. 06101
UOP, 10 UOP Plaza, Algonquin Rd., Des Plaines, Ill. 60016 (subsidiary of Signal Cos.)
Varian Associates, 611 Hansen Way, Palo Alto, Calif. 94303
Jim Walter Corp., 1500 North Dale Mabry Hwy., Tampa, Fla. 33622
Western Electric Co., 222 Broadway, New York, N.Y. 10038 (division of American Telephone & Telegraph Co.)
Westinghouse Electric Corp., 3 Gateway Ctr., Pittsburgh, Pa. 15222
Will Ross, P.O. Box 2012, Milwaukee, Wis. 53201 (subsidiary of G. D. Searle & Co.)
Xerox Corp., High Ridge Park, Stamford, Conn. 06904
Zenith Radio Corp., 1000 North Milwaukee Ave., Glenview, Ill. 60025

Research

Argonne National Laboratory, 9700 South Cass Ave., Argonne, Ill. 60439
Battelle Columbus Laboratories, 505 King Ave., Columbus, Ohio 43201
Battelle Pacific Northwest Laboratories, P.O. Box 999, Richland, Wash. 99352
Bell Laboratories, 600 Mountain Ave., Murray Hill, N.J. 07974 (division of American Telephone & Telegraph Co.)
Brookhaven National Laboratory, Upton, L.I., N.Y. 11973
Carnegie-Mellon Institute of Research, 4400 Fifth Ave., Pittsburgh, Pa. 15213
Chemical Abstracts Service, Ohio State University, Columbus, Ohio 43210
Commercial Testing & Engineering Co., 228 North La Salle St., Chicago, Ill. 60601 (division of Peabody International Corp.)
Denver Research Institute, University Park, Denver, Colo. 80210
Exxon Research & Engineering Co., P.O. Box 221, Florham Park, N.J. 07932 (division of Exxon Corp.)
Franklin Institute, 20th and Race St., Philadelphia, Pa. 19103
Gillette Research Institute, 1413 Research Blvd., Rockville, Md. 20850
IIT Research Institute, 10 West 35th St., Chicago, Ill. 60616
Institute of Gas Technology, 3424 South State St., Chicago, Ill. 60616
Institute of Paper Chemistry, P.O. Box 1039, Appleton, Wis. 54912
Lawrence Berkeley Laboratory, University of California, Berkeley, Calif. 94720
Lawrence Livermore Laboratory, University of California, P.O. Box 808, Livermore, Calif. 94550
Arthur D. Little Inc., 25 Acorn Park, Cambridge, Mass. 02140
Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, N.M. 87545
Materials Research Laboratory, University of Illinois, Urbana, Ill. 61801
Midwest Research Institute, 425 Volker Blvd., Kansas City, Mo. 64110
North Star Research & Development Institute, 3100 38th Ave. South, Minneapolis, Minn. 55406
Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tenn. 37830
Radian Corp., P.O. Box 9948, Austin, Tex. 78766
Rand Corp., 1700 Main St., Santa Monica, Calif. 90406
Research Triangle Institute, P.O. Box 12194, Research Triangle Park, N.C. 27709
Sandia Laboratory, P.O. Box 5800, Albuquerque, N.M. 87115
Foster D. Snell Inc., 66 Hanover Rd., Florham Park, N.J. 07932 (division of Booz, Allen & Hamilton)
Southern Research Institute, 2000 Ninth Ave. South, Birmingham, Ala. 35205
Southwest Research Institute, 6220 Culebra Rd., San Antonio, Tex. 78284
SRI International, 333 Ravenswood Ave., Menlo Park, Calif. 94025
Sterling-Winthrop Research Institute, Columbia Tpke., Rensselaer, N.Y. 12144 (division of Sterling Drug)
Underwriters Laboratories, 207 East Ohio St., Chicago, Ill. 60611
United States Testing Co., 1941 Park Ave., Hoboken, N.J. 07030